SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVIII.--No. 15. [NEW SERIES.] NEW YORK, APRIL 12, 1873. [$3 per Annum, IN ADVANCE.

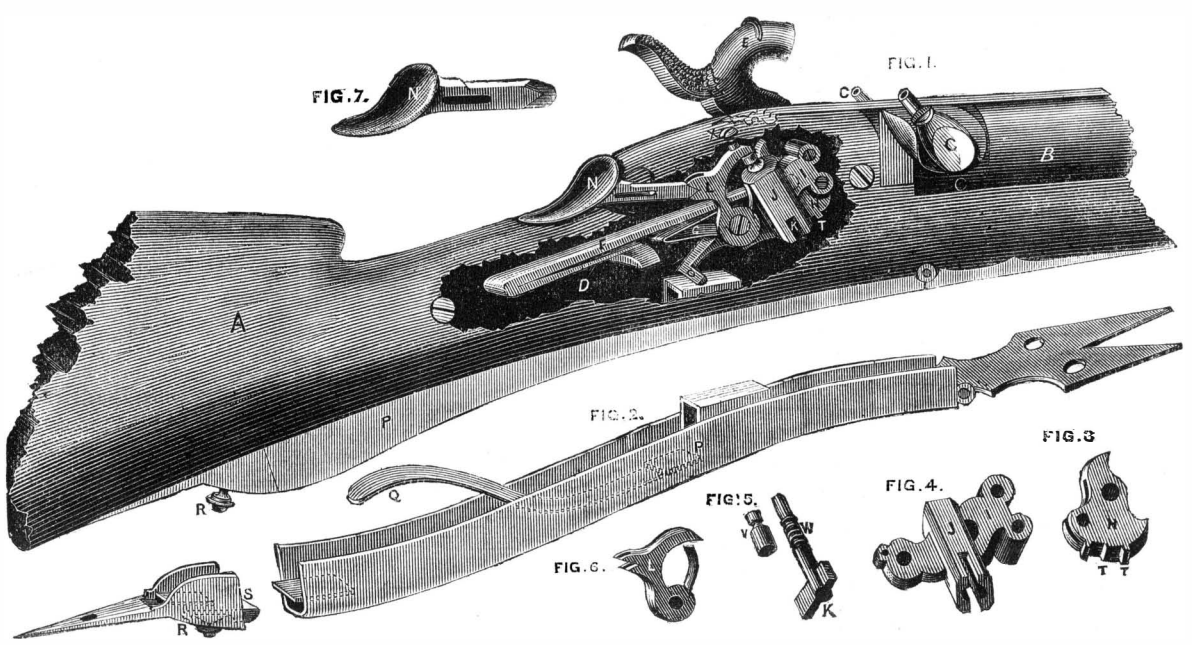
IMPROVED DUPLEX SAFETY GUN LOCK.

We give herewith an engraving of a duplex safety gun lock, patented January 28, 1873, by Dillon H. Mapother, of Louisville, Ky., which, it is claimed, renders the use of firearms perfectly safe to the user. It presents a new principle, in that no single mechanical force will change the lock from a state of rest to one of motion; two forces have to be simultaneously exerted, one of which is involuntarily given by the grasp of the stock. As accident cannot possibly combine two forces acting in different directions at the same moment, it will readily be perceived that only the human hand acting under direction of the will can effect the discharge. The following description, with the aid of the engraving, will render its action plain. When the hammer, E, is down on the cap, premature discharge from any object knocking the hammer up is impossible, as the key, K, fits into the safety notch, T, and holds the hammer perfectly locked in its position. To cock the gun, the thumb of the right hand, pressed lightly upon the upper trigger or thumb shoe, N, by the action of the cam lever, L, depresses the plunger and propels the key beyond the line of the tumbler, H, when the hammer may be raised with the forefinger. It is now again securely locked in its position, as the key fits into the second safety notch, T, while the sear, O, obtains its hold upon the tumbler; the action of the mainspring, F, being doubly prevented, nothing but a duplex or twofold action will release it; accident may act upon one trigger and remove one hold upon the tumbler, but the other will remain. In effecting a discharge, the natural grasp of the handle of the stock acts on the lower trigger, P, detaching the sear, and when an aim is obtained, a touch of the thumb instantly releases the mainspring, and brings down the hammer on the tube. By the action of the graduating screw, X, on the cam lever, the key may be depressed so as to have but a very fine hold on the tumbler, thus constituting it a hair trigger. The locking bolt, S, serves as a support for the lower trigger when drawn back, and, when pushed forward, also securely locks the trigger, preventing its action on the sear: the loaded gun may thus be laid aside with safety; it can be cocked, but cannot be discharged until the bolt is withdrawn. The half cock notch retains the hammer just clear of the cap, and protects both the hammer and cap from explosion and from percussion. This position is of course essential for breech loaders. From this point the gun can be cocked without depression of the plunger, but the hammer cannot be precipitated back on the cap by any accident, or even by intention, until the hammer is brought to full cock.

The invention is applicable to gun, rifle, and pistol, to both muzzle and breech loaders, to either bar or back action locks. In addition to its safety, the inventor claims the following advantages:

The mode of discharge is less disturbing to aim than the old trigger, because the slight push required is directly in the line of the object; whereas, in the old trigger, the pull is directly contrary, and has a tendency to depress the barrel. The discharge is more instantaneous, because the trigger or thumb shoe is as directly in the line of vision as the sight pin; it requires no nervous telegram from brain to forefinger to discharge the piece at the instant the aim is obtained. When the discharge of the second barrel is desired, the transfer is made in half the time that is required in changing triggers with the forefinger. By no possibility can the gun be fired without concurrence of the will, as frequently happens with nervous fingers on triggers in the excitement of the hunt. By no possibility can both barrels be discharged at once, both upper triggers not being in line, and a ridge (between them, in the stock) preventing such an accident. The gun can be handled readily with gloved hands; even buckskin gloves may be worn in the field, which greatly increases the comfort of sportsmen. The gun is more convenient to handle, there being no guards, and the recoil cannot bruise the middle finger, which is often the case on frequent firing. As long as the lower trigger is locked, the gun, though it may be cocked, cannot be discharged; to withdraw the bolt requires an exercise of will, an evidence of intention. These locks but slightly increase the weight of the gun. A double barreled shot gun (30 inch barrels of No. 15 bore) to which they have been applied, weighs but seven pounds; and the use of aluminum, instead of German silver, for the lower trigger, would reduce this; moreover, the increased weight of, say four ounces, is in a position to improve the balance of the gun.

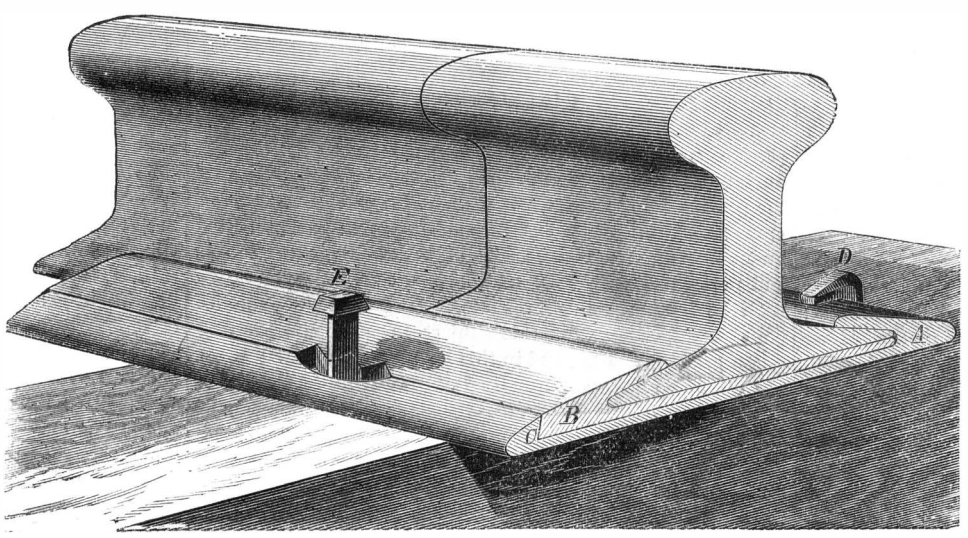
For further information the patentee may be addressed as above.



MAPOTHER'S DUPLEX SAFETY GUN LOCK.

COMPOUND CHAIR FOR CONNECTING RAILROAD RAILS.

We present herewith a novel and effective form of railway chair, which is so constructed as not only to serve as a firm support and means of connection for the ends of adjacent rails, but also to afford a means of tightening the joint in case it should work loose. The advantages of a device thus arranged will be at once obvious to all who have experienced the defects of the ordinary chair now in use, and its superior efficiency will doubtless more than compensate for its small additional cost.



COMPOUND CHAIR FOR CONNECTING RAILROAD RAILS.

In our engraving the bed plate is shown at A, and is constructed with a hook flange on one side and a dovetail, C, on the other. B is the fastening plate, and is provided also with a hook flange, the edge of which is received in the dovetail, C. The last portion is wedge-shaped, so that in driving the two plates together the fastening plate acts as a key. It will be noticed that the rails are firmly grasped by the two hook flanges.

The spikes at D, and the single one at E, secure the chair to the tie. The spike, E, passes through a hole in the bed plate, and engages in one of the three notches—any number may be used—in the fastening plate. When through the wear of the rails the joint becomes loose, this spike, E, may be withdrawn and the fastening plate may be driven up, that is, in the direction from right to left in our engraving. The hold of the chair upon the rails will thus be tightened. On replacing the spike, it will engage with a new notch.

Another arrangement of parts, having the same effect, consists in making the notches at the butt extremity of the plate, B, and, instead of the spike, E, substituting a square headed bolt, headed into the end of the plate, A, at C. When the chair is keyed up, by turning the bolt its head engages in the notches and forms the lock. This is a recent improvement and perhaps more advantageous than the method above described, as it renders the device complete in itself.

As regards the economy of this system, it is stated that the plates, A and B, are rolled in any ordinary rolling mill, and may, consequently, be manufactured at a very moderate cost. They are, as we have shown, adjustable to the rails, so that the latter may always be retained in proper position, thus securing an even tread for the car wheels.

A patent through the Scientific American Patent Agency has been allowed for this invention to Mr. D. D. Eldredge, Post office box 225, Bedford, Lawrence county, Ind., from whom further particulars may be obtained.

Flames from Compressed Gas.

M. F. Benevides, Professor of Physics at the Industrial Institute of Lisbon, communicates to *Les Mondes* a note of his investigations upon the above subject. He states that combustible gases, compressed and burnt in the air, cause some interesting phenomena, which may be readily observed. Among others it may be noted that, when the gas is under great pressure and consequently escapes from the apparatus in large quantities under a high velocity, its flame proper does not begin at the orifice of exit, but at some distance above it. There merely appears at the apertures a slight glow, which is separated by a large obscure space from the luminous jet. The dimensions of this interval depend upon the pressure, rapidity of exit, and quality of gas, while its temperature is quite low. This M. Benevides considers due to the mechanical action of the current of gas, which forces the air back to a certain distance and thereby cuts off the supply of oxygen necessary for combustion. Above the obscure space, the gas, having dilated, mixes with the air, and a luminous jet of high temperature is produced. On increasing the flow of gas, air becomes drawn in with it, and the brilliancy of the flame disappears though the temperature is greatly augmented. Finally, when the aperture is small and the velocity great, the air is crowded away, and ignition will not take place.

In cities in which localities varying greatly in level receive gas for illuminating purposes from the same gas meter, at points above the source of supply effects analogous to those above described may be produced. The reason is that, other circumstances being equal, the rapidity of the escape of the gas is greater in elevated situations because this velocity depends on the difference between the pressure of gas and that of the atmosphere, and the atmospheric pressure becomes less in proportion as the altitude of the point of observation increases. In cities, therefore, like Lisbon, and we may add Boston or Albany, at situations near the level, it often happens that the supply of gas fails during the day, while at more elevated spots there is always a sufficiency. It follows, then, that in order to have the same brilliancy of light, burners and conduit pipes being the same, the opening of the valve regulating the supply must be greater for the low localities than for those on eminences. In positions high above the sea level, if the supply valve be widely opened, the rapidity of escape of the gas becomes very great, and air is drawn in with it; and, consequently, the effect of the Bunsen burner is produced, as before noted.

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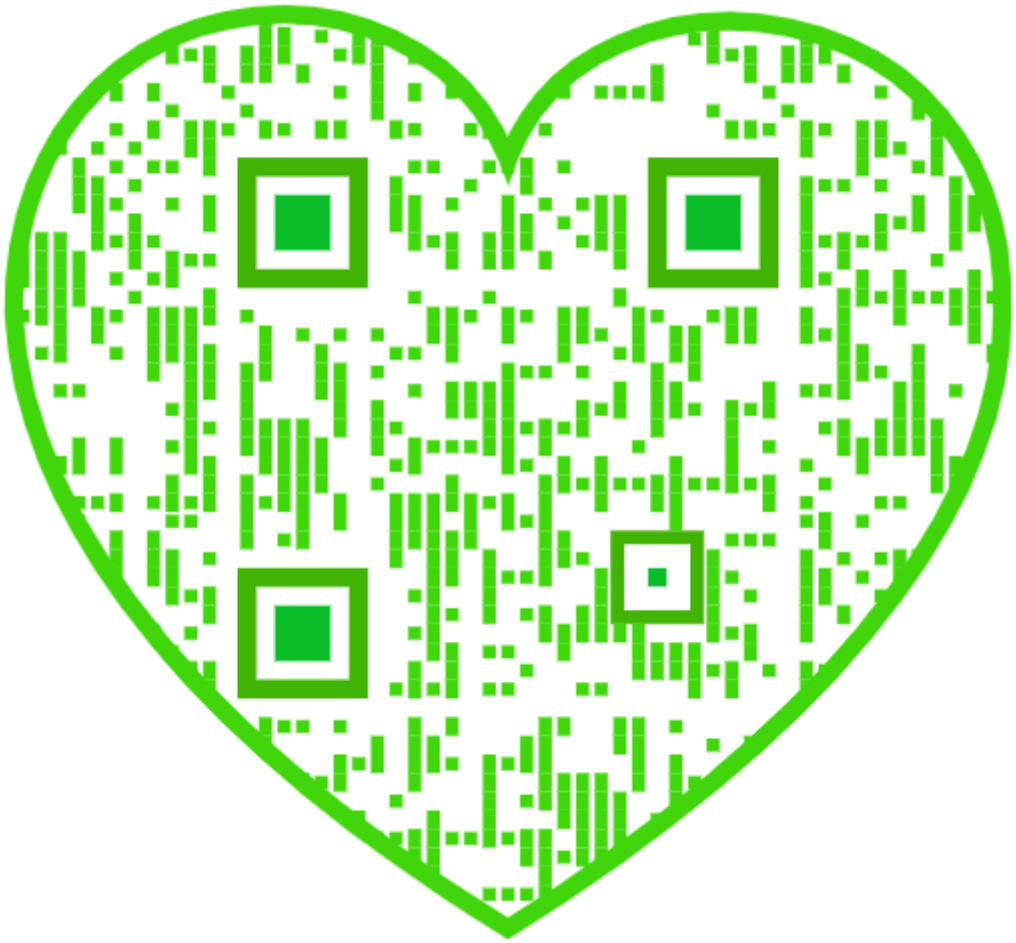

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 15. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, APRIL 12, 1873.

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ASTRONOMICAL EFFECTS OF THE OCEAN TIDES.

The calculation of the enormous amount of power of the ocean tides, published in a former article, on page 64 of our current volume, being based on figures which are to a certain extent estimates only, may appear to many as exaggerated, and, no doubt, to others as below the real value; certain it is, however, that all will agree that an immense amount of power is here developed, while at the same time it is evident that the tidal wave, which runs from east to west and spends its force on the eastern coast of Africa and South America, not to speak of many islands, must exert some influence on the earth's rotary motion from west to east, tending to cause a retardation of that motion.

But enormous as is the force thus exerted, measured by many millions of horse power, it is a mere trifle compared with the earth's weight, which may be thus computed: Accepting the terrestrial radius, in round numbers, as 4,000 miles, the earth's cubic contents are, according to the formula $\frac{4}{3}\pi r^3$, equal to $\frac{4}{3} \times 3{\cdot}1416 \times 64{,}000{,}000{,}000$ or more than 200,000,000,000 cubic miles. Considering that a cubic mile is equal to 147,197,952,000 cubic feet, the contents of the globe are equal to very nearly 30,000,000,000,000,000,000,000 cubic feet; and as the mean specific gravity of the earth's mass is $=5$, every cubic foot weighs on an average 5×62, or 310 pounds; and the whole weight of the earth is equal to 9,300,000,000,000,000,000,000,000 pounds. As a large portion of this mass moves with a velocity of 133,000,000 feet in 24 hours, or 1,440 minutes, it has, perhaps, a motion of almost a hundred thousand feet per minute, a momentum compared with which the 500,000,000,000,000 foot pounds per minute, which we found, on page 64, to be the power of the ocean tides, becomes rather insignificant. The first number divided by the second giving a quotient of 180,000,000,000, and this forcibly proves its comparative unimportance.

But as even a comparatively small power may in the end manifest its results, if it is only given a proportionately long time wherein to exert itself, the question has been raised: Does not the earth show any retardation in its motion, if we compare its present velocity with that of the most ancient observations which have come down to us? William Herschel, considering that such a question cannot possibly be settled by clocks or time pieces, proposed to use observations on the rotation of planets, in some of which their time of revolution can be determined within a second, by means of marks on their surface. Unfortunately, Jupiter has such a variable surface on his vaporous atmosphere, that all Herschel's observations on the same were labor lost; only the observations on Mars were found to be available, as Venus and Mercury are too near the sun, and therefore, probably, their own revolutions are retarded more than that of the earth, by the solar tidal waves. Herschel observed Mars at intervals of two years, but by counting one rotation less than had actually happened, he obtained the value two minutes too great; Maedler obtained, later, a value which was only one second too great, while finally Professor Kaiser, of the University of Leyden, Holland, by combining many observations, obtained a value which is correct to within one fifteenth of one second. Proctor, of London, sets down the time of Mars' rotation period at 24 hours 37 minutes 22·74 seconds, a value which at some future time may serve as a test for the period of the earth's rotation. Proctor claims that it is correct to within one hundredth part of a second; if so then, if, after a century, the earth's rotation has changed only the one hundredth part of a second, posterity will be able to measure the amount of retardation.

In the meantime human impatience has looked out for other means of measurement, and one has been found in the moon's revolution around the earth. If we calculate the eclipses back for long periods of time, say two thousand years, the calculations do not agree with the actual eclipses as recorded in history; this puzzled the astronomers at first, till La Place tried to prove that the moon must be subject to a periodical accumulation and retardation in its motion, which must be really very minute and only perceptible in long intervals of time, notwithstanding that she travels faster and faster, and will afterwards restore the gain by going slower and slower. Mayer later denied the periodicity of this lunar motion; he only admitted the acceleration, on the ground that the moon was coming nearer and nearer to the earth; and he maintained that in the course of ages she must come down and destroy everything on the terrestrial surface. From La Place's calculation the conclusion was drawn that the period of the earth's rotation had not varied one tenth of a second per century for the last two thousand years; this was accepted and discussion set at rest, till Adams reviewed and corrected the calculations; then came Hansen, who proved by more elaborate researches, concerning eclipses recorded in history, that the moon's acceleration was more than twice as fast as La Place's and Adams' calculations would admit; this was agreed to by Adams, who admitted that at least half, if not all, this acceleration is apparent only, and is due to a retardation in the earth's rotation, caused by what he calls a brake, namely the tidal wave, which must do work in sweeping twice a day around the earth in a direction contrary to her rotation.

The result of the latest researches is that the earth in its rotation has, in two thousand years, lost nearly an hour and one quarter, and is losing now at the rate of one second in 23 weeks, so that our days are one eighty-fourth part of a second longer than they were two thousand years ago. If the rate of retardation is kept up, the length of a day will become equal to a lunar month in 36,000,000,000 years, and equal to a year in 468,000,000 000 years; that means that then the earth will revolve once a year around its axis and behave towards the sun as the moon does now toward the earth, that is, turn always the same side to its source of light; but it is evident that the change will in course of time become much slower, and that some trillions of years must elapse before these full changes will be effected.

A SIMPLE METHOD OF IMPROVING THE HEALTH OF CITIES.

Dr. Alfred Carpenter, of London, strongly recommends the connection of all house drains with one of the chimneys, or with a special ventilating pipe leading to the roof of the dwelling. By this simple arrangement a circulation of air through the sewers is obtained, and the foul gases, instead of entering the house to produce typhoid and other diseases, would be oxygenized, rendered innocuous and dissipated.

In New York, and other cities, there are thousands of unhealthy dwellings, made so by the back pressure of air from the sewer pipes, which would be instantly cured by the use of a few feet of pipe to connect the house drains and water closet pipes with the chimneys. We believe that the passage of a law requiring the insertion of such pipes would be an excellent sanitary provision. We compel the owners of tenement houses to place fire escape ladders upon the outsides of their buildings, as a means of saving life in case of conflagration. But a far greater number of lives might be saved if owners were compelled to put in vent pipes as above indicated. Noxious air from the sewers is one of the main causes of disease and death in all large towns.

CARBONIC ACID IN THE SOIL.

It is well known to every one that plants derive much of their subsistence from the air about them, and that their principal articles of food are carbonic acid and water. The presence of large quantities of the former in the atmosphere during the carboniferous period of geological history caused the plants of that time to attain great luxuriance and enormous size. But plants find also a supply of carbonic acid under the earth's surface, the solid earth being in fact porous and permeated with gas, of which the quantity increases with the depth of soil. Dr. Pettenkofer has made some interesting experiments on this subject in Munich. He first dug a pit 14 feet deep, and in this he placed fine lead pipes of 0·4 inch diameter, and ending at different depths. The first reached to the bottom of the pit; a second went to a depth of 10 feet; a third about 8 feet; a fourth 5 feet, and a fifth 2¼ feet. The upper ends of the tubes were carried into the laboratory, and connected with aspirators. After filling the pit with the earth taken out, and pounding it firmly down, it was found that air could be drawn through all the tubes just as easily as if the tubes were suspended in the open air. In the course of from 2½ to 3 hours, from 13 to 16 quarts of air were drawn through the tubes; and the amount of carbonic acid was determined by absorbing it in baryta water. Observations were made at all seasons of the year, and the quantity of carbonic acid was found to be greatest in August and September, when from 14 to 16 parts of this gas were found in 1,000 parts air from a depth of 14 feet. The smallest quantity found at this depth was in January, when 3·46 volumes of gas were found in 1,000 volumes of air. The air nearer the surface contained much less of the gas, except in the months of June and July. The experimentor thinks that this carbonic acid may be produced by organic processes in the soil, being given off by living organisms of a very low order. The fact that the amount decreases as we come nearer the surface is attributed to the diffusion of it into the air, ventilation being less perfect in summer than in winter, as is the case in a dwelling or elsewhere. Nearly the whole amount of carbonic acid present in the atmosphere, he thinks, comes from the soil. It was noticed, by Schulze, in 1871, that when the wind blew from the sea, the percentage of this gas in the air was less than when the wind had travelled over the continent. Roscoe established the unexpected fact that all the furnaces and chimneys in busy Manchester did not perceptibly increase the amount of carbonic acid in the atmosphere of the city; much less could the manufactories scattered over the continent explain the phenomenon observed by Schultze. The supposition that it is everywhere given off from the soil is the only plausible explanation of it. We hope to hear of the experiments being repeated in different parts of our own country, so that the results of different observers may be compared.

STEAM ON THE FARM.

We recently published an engraving of an English steam mowing machine, which, for its simplicity, has attracted much attention. Something has been done in the same line in this country. A correspondent suggests that there is an extensive demand for small portable steamers, for farm use, with attachments to render them applicable to various purposes. For example such machines should be capable of use in working mowers and reapers in lieu of horses; of driving plows, seeders, harrows, saws, grindstones, flouring stones, straw cutters, threshing machines, pumps, drawing wagons on common roads, pulling stumps, operating ditching machines, etc. Here is a field for the ingenious.

The application of steam to farm labor is at present in its infancy. One of the first requisites for its general introduction will be the instruction of farmers in the principles and economies of the steam engine—studies that are at present almost wholly neglected in our common schools.

EUROPEAN STREET CAR IMPROVEMENTS.

In Edinburgh, Scotland, where there are steep hills and where street railways are just coming into use, Mr. Gillespie has devised a safety brake. It consists of a bar, running longitudinally along the bottom of the car. A number of strong prongs project from the bar. The arrangement is such that, when the driver moves a certain lever, the pronged bar drops and the prongs strike upon the pavement, entering between the stones, and instantly stopping the car.

In London, Messrs. Holmes and Taylor have invented a contrivance for storing up the inertia or power of the car lost in stopping, so as to apply that power to the starting of the car, thus relieving the horses of the severe strain now required at the moment of starting the car. The device consists of a torsional spring, arranged under the body of the car, working in connection with gear wheels upon the car axles.

The use of springs for this purpose is very old in this country, and has been tried in various forms without much practical economy. The expense and weight of the parts has proved, on the whole, disadvantageous.

NEBRASKA PATENT LAWS.

A correspondent states that the Nebraska legislature has passed one of those wretched local laws in regard to the sale patents which disfigure the statutes of several other States, and are without force, legal or moral. This Nebraska law enacts, first, that it shall be unlawful for any person to sell or barter, or offer to sell or barter, any patent right, in any part of that State, without complying with such law. Next, the seller of the patent is required to submit a sworn copy of the patent to the Probate Judge of the county, give his name, age, residence, occupation, and go through with such other humiliating examinations as the judge may take a fancy to order; and then, if the judge thinks it a proper case, he may grant a certificate showing that the applicant is duly authorized to sell his patent within the limits of Nebraska. The seller is then required to exhibit the certificate to everybody he meets on the street, if they ask for it. Next, in case the seller bargains with a man for his patent, and agrees to take a note in part payment, he must write or print thereon, in prominent letters, the words "*given for a patent right*;" and the value of the note is to be impaired by being made subject, if transferred to a third party, to all the defenses that might exist if owned by the original receiver. Finally, if the patentee or seller of a patent shall fail to observe any one of these requirements, he is to be deemed a criminal, and on conviction is to be fined five hundred dollars, or imprisoned six months, or both, at the discretion of the court; and is also to be liable for damages in a civil action.

We pity the stupidity of the legislators who could enact such a law. It is in direct contravention of the laws of the United States, which declare that the patentee, his heirs and assigns, shall possess the exclusive right to make, use and vend the patented invention throughout the United States and the Territories thereof. But Nebraska, it appears, undertakes to legislate the inventor out of these rights, and take possession of them itself, without so much as offering compensation.

We need hardly say that this law of Nebraska, and similar laws in other States, are all of them unconstitutional, and have been so declared by the United States Courts. We published the decision to this effect some time ago.

Any judge or other person in Nebraska who undertakes to interfere with a patentee in the sale of his patent, under the pretended authority of a Nebraska law, makes himself personally liable to penalties under the laws of the United States.

If the object of the Nebraska legislators is to save its simple minded citizens from the cheats and tricks of designing knaves, who, under cover of pretended patents, pretended

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land grants, pretended mines, and fraudulent pretences of various kinds, go roaming about the country plundering whomsoever they can: if such is the object, surely there must be some other way to its accomplishment than interference with the vested rights granted to individuals by the laws of the United States.

A much better plan would be the passage of a law by the legislature authorizing the Governor of Nebraska to purchase from the patentee, on behalf of the State, the right to every new and useful patented invention that might be presented, all citizens of the State to enjoy the free right of use thereof. This would relieve the citizens of all necessity of buying patent rights, the United States laws would be complied with, the useful arts would be splendidly encouraged, and Nebraska soon become the most intelligent, wealthy, populous and prosperous State in the Union.

A MUNIFICENT GIFT TO SCIENCE.

Some time since Professor Agassiz in an address before the Legislature of Massachusetts called the attention of that body to the need and value of a summer school for the instruction of both teachers and students in natural history. He also suggested that, during the coming summer, a session should be held on the island of Nantucket. These remarks attracted the attention of Mr. John Anderson, a wealthy and well known tobacco merchant of this city, who with great munificence has donated an entire island for the purposes of the institution, supplementing his gift with a fund of $50,000. The island, which bears the name of Penikese, is of about one hundred acres in extent and is situated in the Elizabeth group, at the entrance of Buzzard's Bay, on the southern coast of Massachusetts. It hss been largely improved, and contains several buildings valued at $100,000, while the fertility of its soil is such as to render it possible to raise sufficient produce to pay all expenses of the school.

Professor Agassiz considers that the site is eminently suited for the purpose as affording ample opportunity for original investigation as well as instruction. The institution will be carried on throughout the year, in connection with the museum of Cambridge, and measures will be speedily taken to prepare the buildings for use.

ECCENTRIC INVENTORS.

If any one should undertake to write a volume on the subject of inventors—"their vagaries and vicissitudes" would be a "taking" title, as publishers express it—we believe that a tome as ponderous as Webster's dictionary might be produced and yet not exhaust the topic. As a class, they are looked upon as enthusiasts, fanatics, seekers after will-of-the-wisp theories, until some day the public wakes up to the fact that one out of the million has immortalized himself and conferred incalculable benefits on the human race. Then, if it cannot crush him or deprive him of the result of his labors, it bows down to him, pours gold into his pocket, erects statues to his memory, and complacently absorbs his glory under the grand title of our "national genius." Meanwhile, the other nine hundred and odd thousand continue to be "visionary monomaniacs."

The popular notion of an inventor is admirably depicted in a comedy, written by a well known literary lady and recently produced at one of the theaters in this city. The principal character is a childish old man who has invented a flying machine, in his attempts to perfect which he has swamped a fortune. The action hinges on the efforts of his daughter to save him from further waste and to protect the family homestead, which, it seems, her father mortgages to obtain money to pursue his scheme. Though the play has not been successful, to this one character we can award hearty praise. The utter indifference to every subject save his invention, the desire to sacrifice everything, even the roof over his head, for the "benefit of mankind," the earnest catching at every word of encouragement, the delight of the old man when the wily lawyer who is plotting against him promises assistance, and his total despair when he finds his means all gone and himself unable to put "the very last and finishing touch" to his device, were most graphically depicted; an old friend was on the stage before us, repeating familiar words.

Fortunately, the eccentricity of genius is the exception and not the rule, while it is the prominence which individuals unwittingly give to themselves that leads them to be regarded as types of a class. We constantly hear of schemes as impracticable and as wild as the search for the philosopher's stone or the elixir of life. The quest of perpetual motion is indeed our modern alchemy. Often we learn of instances of labor so patient, and confidence so implicit in future triumph, that the very pathos of the case disarms condemnation. There is an old man who haunts the halls of Congress in Washington; he has done so for years, with a faith which is wonderful, if not sublime. He is over seventy years of age, always neatly dressed, though there is a tinge of mild decay now coming over his raiment, and generally wanders about with a bundle of pamphlets under his arm. He is ready to explain his theory to any one, and advances his views in the mildest and most deferential of terms until some person ventures to doubt their practicability, when a tigress robbed of her whelps could not be more incensed. His invention is something about applying cement to the banks and bottoms of canals, so that the earth cannot be washed away, while the cutting may at the same time be easily kept clean. The old man believes most implicitly that some day the government will adopt his system and, by some mysterious process in the committee rooms, an appropriation will be awarded him. Session after session passes and still he waits; nothing wearies him, and rebuffs are of no avail. Recently he has been villanously swindled by two men said to be high in political position, who have taken his money and promised to assist him; but they have done nothing except put him off with lying excuses, and Congress meets and adjourns without knowing of the existence of either the inventor or his ideas. Thus he will continue, pouring his scanty means into the hands of these harpies, and coming from his home in Ohio to Washington every winter until death overtakes him, as far at the end as at the beginning from the realization of his wild phantasy. There is a humorous as well as a grave side to the subject: perhaps the majority of cases would excite laughter before pity. A metaphysical genius with unkempt auburn locks and dilapidated garments infests newspaper offices and the Liberal Club in this city. He is ready at all times to argue anything, but has a particular fondness for metaphysics and squaring the circle. For accomplishing the latter, he has invented a new process, which consists in considering the difference between the circumference and the circumscribed polygon as an infinitesimal quantity too small to be noticed. It is needless to state that by this method he arrives at, to him, perfectly satisfactory results.

Another instance is that of a recent exile from Erin who, for some time past, has been seeking to secure the adoption of his invention by Congress. It was suggested at one time to fire cannon at different villages throughout the country to warn farmers of the approach of a storm. This idea our Irishman had improved upon, and he claimed that his signal could be heard around a radius of twenty-five miles from his machine. The device was economical, simple, supplied a want long felt, etc., etc., the usual formula. He worried the Committee of the House on commerce to procure him an appropriation—a hundred thousand dollars or so—but persistently refused to tell what his invention was. He "didn't propose to let his secret out and be robbed, but wanted the appropriation first." Finally he consented to allow the Light House Board to investigate the matter.

It was discovered that the device consisted in a huge funnel with the little part down and the big part up. The little part was to be fitted with a whistling apparatus and arranged upon a framework at some distance from the ground. When the telegraph should bring intelligence of a coming storm, an immense plug, hanging above the funnel, was to be loosened, when it would descend with great rapidity—pile driver fashion—into the funnel, forcing the air into and through the lower small part of the machine and thus produce a sound of stupendous volume which would be audible for twenty-five miles. The Board heartlessly reported against the invention, and the inventor was last heard of endeavoring to convince the public that the examiners had been bribed by an envious rival.

THE IGNITION OF COMBUSTIBLES BY OVERHEATED STEAM.

To the Editor of the Scientific American:

From time to time, I read communications in your journal which lead me to believe that you are not now as sure as you were that the theories I have heretofore advanced in relation to the title subject of this letter are "absurd." I now have the satisfaction to be able to forward to you an extract from the log of the United States steamer, Alaska, which I have been able to obtain by favor of the Secretary of the Navy, Hon. Geo. M. Robeson, giving an official account of a fire which occurred on that vessel on January 19, 1870, a more full account of which was published in the New York *Sun* soon after; to which account I have frequently referred in the discussions which have taken place before the Polytechnic Club of the American Institute, and I forward this to you at the earliest opportunity, in response to the oral demands you have frequently made on me for facts:

"January 19, 1870. 4 to 8 A. M. Fires very low. At 7.50 discovered that the felting over No. 2—forward starboard—boiler was on fire. Led a stream of water to the same, and sent word to the officer of the deck. (Signed)
EDWARDS FARMER, 1st Assistant Engineer.

"From 8 A. M., to Meridian. Felting found to be on fire on forward starboard boiler; was not fully extinguished till 11 A. M. Hauled fires in forward starboard boiler at 9 A. M., and in all the others at 11 A. M. Stopped engines at 9.20 A. M. (Signed) JAS. P. SPRAGUE,
1st Assistant Engineer."

The log further shows that, next day, when the lead plates were removed, it was found that the felting on all the boilers was charred, although the worst charring was found on boiler No. 2. It seems impossible to believe that the felting on any of these boilers, securely encased in sheet lead, was to any degree saturated with oil, and consequently your ingenious hypothesis of spontaneous combustion is not admissible in this case. NORMAN WIARD.

Washington, D. C., March 15, 1873.

REMARKS.—The theory held by Mr. Wiard is that a prolific cause of fires is the superheating of steam in boilers and steam pipes—such superheating being occasioned by low fires. For example, at night, when fires are hauled, and the circulation of steam rendered *nil*, Mr. Wiard thinks that the small quantity of steam in the boilers, above the water, and lack of circulation promote superheating, and that the upper part of the boiler and adjacent steam pipes become so hot as to readily ignite wood work or other combustibles.

We have had occasion to point out to Mr. Wiard the extreme difficulty of heating up steam to the igniting temperature, nearly 900° Fahr., under any circumstances; and have expressed the opinion that it was almost impracticable to do so, in ordinary steam boilers, with banked fires, as he claims. This is the nub of our difference with our correspondent, for whom, personally, we entertain the highest respect. In most of the examples of mysterious combustion, where steam boilers and pipes were used, it has appeared on careful examination that the fire was probably due to spontaneous ignition, or escape of gas from furnace doors, not to superheated steam. Mr. Wiard has claimed to possess positive personal knowledge of many examples of fires caused by the overheating of steam as he alleges. We have invariably requested him to give us names and places, in order that we might personally verify the facts, and by their publication in the SCIENTIFIC AMERICAN enable engineers and owners to take warning. But although our correspondent has frequently promised to furnish the necessary data he has never, until now, done so except on one occasion, when he gave us an address in this city, where he said we might call and learn the facts of a case of superheated steam ignition, provided we would agree not to publish the matter. The reason assigned for withholding publication was that the owners were afraid that the insurance companies would refuse to take risks on the property. We declined to investigate unless we were permitted to publish the facts.

Mr. Wiard then assured us that the Fire Marshal in this city was in possession of facts pertaining to many examples of fires occurring here, caused by superheated steam, to which we might have access at any time for publication. We at once applied to the Fire Marshal, but were unable to ascertain that he was in possession of information in a single case, where fire could be traced to superheated steam.

We have heard nothing more from Mr. Wiard until now, and here he gives us the latest proofs of his pet theory. But to our minds they are not convincing. We understand from this report that, at the time of the fire, the engines of the vessel were in motion, and the fires low, which indicates the circulation of steam at a low temperature, and forbids the supposition of superheating.

Mr. Wiard thinks it impossible to believe that oil could have been present in the felting, thus causing spontaneous combustion. But he gives no reason why such a belief is impossible. We have published examples of the spontaneous ignition of clean cotton fibers, without oil, under the favoring influences of a gentle heat. We recently published a report of the engineer of the Providence Water Works, giving an account of the ignition of the engine felting and wood covering at that establishment, on the occasion of an increase in the boiler pressure, and the consequent increase of the steam heat. He made no mention of the presence of oil. But a subsequent report, by another engineer, stated that the felting and wood were both saturated with oil, and that the fire was the result of spontaneous combustion. What we need in all such cases is to know all the facts, and then an intelligent conclusion may probably be reached.

A NEW MITRAILLEUSE.

Interesting trials have quite recently been made at the Holske Machine Works, No. 279 Cherry street in this city, of a new mitrailleuse invented by Mr. J. P. Taylor, of Tennessee. The experimental gun, the first constructed, was built at the above establishment and possesses a number of entirely novel features, well calculated to make it a very formidable weapon. It has twenty-four barrels, which by simply turning a crank may be discharged *en fusillade* or all at once. The loading mechanism is especially ingenious and consists in a magazine of cartridges, placed in rear of the gun, from which four rotating chambers, are fed in succession. The contents of each chamber, as it comes even with the ends of the barrels, are discharged in turn until the reservoir is exhausted, when a new and filled receptacle may be quickly substituted: 700 rounds per minute can be fired by fusillade or 1,000 in broadside. The machinery is simple and so arranged as to be well protected from the effects of shot striking it. The gun, which is exciting no small degree of interest in military circles, is at the present time undergoing a series of careful tests, the results of which, together with a full description and engraving of the piece, will shortly be published in the SCIENTIFIC AMERICAN. The workmanship displayed in the production of this first specimen of the arm is excellent, and reflects the highest credit upon the Holske Machine Company.

Death of Charles Knight.

Charles Knight, the celebrated editor and publisher of illustrated works, of London, died recently in the 82d year of his age. His various publications of useful information are known throughout the world. Among them are the "Library of Entertaining Knowledge," "Family Library," "Penny Magazine," "Penny Cyclopœdia," History of the People," etc.

The Laundry.

A correspondent, J. D. K., points out the mistake made by many housekeepers in using only warm water in washing clothes, under the idea that too great heat sets the dirt. He asserts that half the labor of rubbing may be saved by using a high degree of heat, and for this treatment, a washing machine of some sort is absolutely necessary; and deprecates the use of chemicals as destructive to the fabrics.

M. BOILLOT announces that, by causing the electric current to pass through a vessel containing a mixture of sulphur vapor and oxygen, that he has determined the combination and made the synthesis of sulphuric acid.

THE perihelion of Venus, that is, the moment in its revolution when the planet is nearest the sun, took place on the 7th of last month. Its distance from the sun was then 65,338,824 miles.

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TELEGRAPH POLES.

In India, Central Asia and Australia, where great telegraph lines have been erected, iron poles have been especially made, which have answered all constructional requirements and which have since proved to be the most economical means of carrying wires above ground.

On the application of iron to this purpose, Major Webber lately read a paper before the Society of Telegraph Engineers in England, in which he adverted to the different forms of metal poles proposed. Some are constructed like railway signal posts, others like split tapered tubes, telescopes, lattice and ribbons. Others again have been made of multiple iron bars of T and H sections or of cast and wrought iron tapered tubes, connected by socket joints. As a general rule no one design is applicable to all situations, for on ordinary roads the mathematical curves of a railway are not met with, but in their stead, every abrupt angular change or tortuous winding. The poles should be strong enough to carry the weight of the wire at the requisite hight from the ground without bending, and rigid enough to resist the pressure of wind. When placed in the ground straight, they will require no side support, but when at an angle, they will hardly resist the lateral strain due to the wires. A wooden pole, unless placed so as to partially convert strain into thrust, cannot long resist strain with the resistance furnished by the ground alone. The difficulty lies, not in making a pole with the necessary strength, but in obtaining a sufficiently unyielding mass to hold it upright against the horizontal strains to which it is subjected.

Lieutenant Jekyll, R. E., having analysed the forces to which poles are subject, considers a stay superior to a strut in affording support. Where stays or struts cannot be fixed at the same hight as the wire, it is better to attach them above than below it. An iron loop at the arm bolt would form a good means for the attachment of a stay; the loop should be put on inside the arm and be galvanized. The defects of struts are sometimes remedied by anchoring or foot-staying the pole and by bracing the pole and strut together in the middle with twisted wire; though even this precaution does not prevent the top from bending.

When local circumstances preclude the use of either stays or struts, trussing may be employed with advantage. The pole for this purpose is supported horizontally by a crutch at each end, in which position it sags slightly in the middle. A block of wood about two feet in length and the same thickness as the pole, is halved into and spiked to the butt of the pole at right angles to its length. A spur about 1 foot in length is fixed on the side of the pole, half way between the ground line and the top. An ordinary stay rod is grooved into the side of the butt and passed through the block at the bottom, and an iron loop is attached to the bolt of the top arm. A twisted wire stay is then made between the loop at the top and the eye of the stay rod at the bottom, which, when tightly secured, is stretched over the spur as a bow is drawn. It will then be found to be quite tight and to impart a slight bend to the pole, which can be further increased if required by screwing up the nut at the end of the stay rod. The block at the bottom may be bolted side by side to the pole, and a four-armed spur is recommended. The truss wire must be placed on the same vertical plane with the resultant of the wire strains. The ground, and especially near the foot, where blocks should be used, must furnish the necessary support. In cases of withstanding exceptional pressures, double or A poles are sometimes used.

Mr. W. Siemens considers that in the employment of iron poles a buckled wrought iron foot plate is of advantage, as affording a much firmer foundation. The portion of the post which is partly buried in the ground and therefore exposed to the simultaneous action of moisture and air, is made of cast iron and is of tubular form. This tube is fastened to the buckled plate by means of four bolts, and is provided at its upper end with a suitable pocket to receive the upper tube, which is made of wrought iron. The shape is approximately parabolic. The tubes are cemented with a mixture of sulphur and oxide of iron. 180,000 poles, thus arranged, have been erected by the Messrs. Siemens in South America, with satisfactory results. They are not as cheap as wooden poles in the first outlay, but are of course not subject to dry rot.

Continuous Railway Brakes.

Mr. W. H. Fox, C. E., recently read a paper on the above topic before the English Society of Engineers. His conclusions are that every engine and carriage should be fitted with brake apparatus capable of reducing it from a speed of sixty miles per hour to a state of rest in a distance not exceeding 220 yards on a level, in ordinary weather; that a retarding force of 18 per cent of the weight of the train is sufficient to do this; that cast iron is generally more suitable than wood as a material for brake blocks; and that experiment shows that a pressure of 2½ tuns is required to be applied to the cast iron blocks fitted to each of the four wheels of a carriage weighing 10 tons, and 1·8 tuns if wooden blocks be used in like manner. The author considers that the atmospheric brake complies with nearly all the conditions necessary to be fulfilled by a perfect continuous brake.

MAPLE SUGAR as an article of merchandise is in a fair way of extinction. The maple forests of New England are being yearly cut down and converted into broom handles. Thousands of splendid trees, monarchs of the woods, which have for a generation yielded full quotas of sweet sap, are annually felled. At the present rate of destruction, maple sugar and maple broom handles will before long, be unknown in trade.

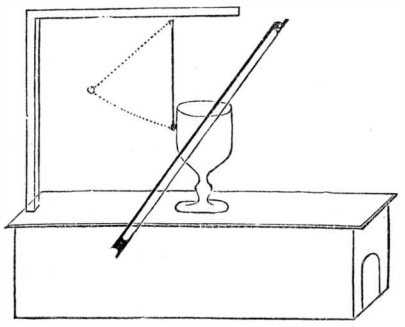
SOUND AND HEARING.

Professor Louis Elsberg, of the Medical Department of the University of the city of New York, lately delivered a lecture at the Cooper Union in this city, which is reported in the *New York Tribune* as follows:

The speaker said that sound was vibratory motion of matter, appreciated by the hearing organ. This fact could be illustrated in an endless variety of ways.

SOUND VIBRATIONS.

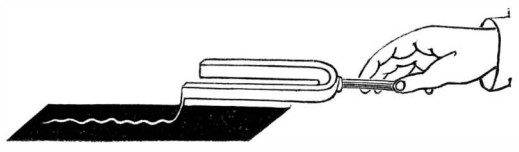
In the experiment which he introduced at this point a violin bow was draw across the the rim of a tumbler firmly



fixed in a support. A sound was produced, and a wooden ball suspended at the side of the tumbler was thrown to a distance. This showed that vibration of particles of matter, taking place a certain number of times within a certain time, produced sound. To become sound, vibration must take place at least 16 times per second. We can cause a sounding tuning fork, he said, to write the history of its motion by its own autograph, or its phonautograph, as it is called.

SOUND WRITING.

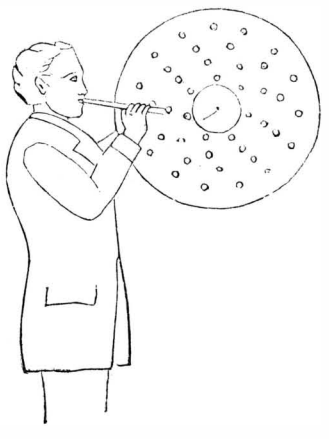
In this experiment, a tuning fork with a thin piece of sounding brass attached was struck, and then drawn over a



piece of blackened paper. A waving line appeared on the paper where the thin brass had scraped off the lampblack. By noting the time we take to write, said the lecturer, we may determine the number of vibrations of the particular sound. In this case you would find 48 points made in one quarter of a second, hence the sound of the tuning fork is G of 192 vibrations in a second. The speaker then went on to show that the forces—sound, heat, light, and electricity—were all the result of vibrations, and could be converted one into another. The difference between noise and sound was declared to be that, while the latter was the result of regular, the former was produced by irregular vibrations.

I have stated the limits of audible sound to be the rates of vibration of 16 and 38,000 in a second, which embrace more than 11 octaves, but those of effective musical sounds are much less. The clangs used in music are almost never lower than 32 vibrations in a second (the lowest C on the pianoforte), thus comprising seven octaves.

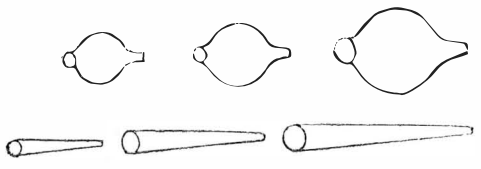
THE SIREN.



Essentially, every siren consists of a rotating perforated disk, against one or more points of which a current of air impinges. Whenever the air strikes a hole it passes through with a puff, and when the puffs follow each other in sufficiently quick succession they combine, just as any other vibrations, to form a sound of low or higher pitch according to their frequency. When the rate of revolution and the number of perforations of the disk are known, the rate of vibration of the sound produced becomes known.

HELMHOLTZ'S RESONATOR.

Helmholtz has invented a method of analyzing a sound, namely, by means of so called "resonators." These are hollow bodies, one end of which is placed into the ear;



they are so easy of application that any one can make use of them. If properly attuned, they at once reveal the presence of their particular tone, if contained in the sound or sounds under examination. By their employment we can demonstrate, beyond cavil or doubt, that every sound as it generally occurs in nature, as it is produced by most of our musical instruments or the human voice, is not a simple, single sound, but a compound or composite one, composed—aside from a usual admixture of noises—of a number of tones of different intensity and pitch, all of which different tones combined are heard as one.

THE HEARING APPARATUS.

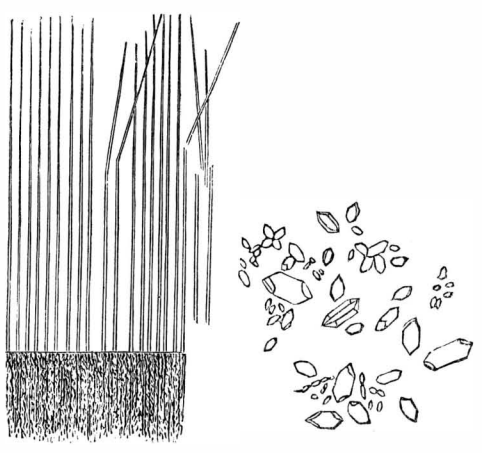
The ear is divided into three divisions, outer ear, middle ear, and inner ear. The outer ear consists of the projecting portion on the side of the head, and the external auditory canal. This canal ends blindly, being entirely closed by the membrane of the drum, or the external drumhead. This drumhead, also called tympanic membrane, or membrane of the tympanum, forms the partition wall between the external and the middle ear.

The middle ear is called the tympanum, the Latin word for drum. Like every other drum, that of our ear contains air, and has, also, a vent hole, or, rather, a long narrow tube running to the posterior part of the nose and throat, the—Eustachian tube, named after Eustachius, the physician who discovered and first described it—by which communication is established between the air of the middle ear and the air of the atmosphere entering the nose and mouth. The other walls of the drum are bony; and across the cavity there extends a chain of three little bones, the hammer, anvil, and stirrup, respectively so called from their shape; the hammer being imbedded in the outer, and the stirrup planted against the inner, drumhead.

The internal ear is the most complicated part of the hearing organ. It is a closed cavity, containing watery liquid, a space of such intricacy that it has received the name "labyrinth." It is situated in the hardest portion of all the bones in the body, in the stony portion of the temple bone; and it is here where the terminal expansions of the nerve of hearing are. In the water swims the membranous labyrinth, a closed bag of delicate elastic tissue, also containing water, and having the same shape exactly as the bony portion of the labyrinth in which it swims, but which it no where touches. In this membranous labyrinth, a branch of the auditory nerve is spread out.

OTOLITHS AND FIBERS OF MEMBRANA BASILARIS.

The auditory nerve consists of several thousand microscopically fine threads of nervous fiber, held together by connective tissue, and has its origin in that part of the brain called the *medulla oblongata*, which is just at the top of the spinal marrow. It passes through this, the internal auditory canal of the skull, and before entering the labyrinth divides into two branches, of which one goes to the vestibule and one to the *cochlea*. The vestibular nerve sends two bundles of filaments into the vestibule, where numerous very small, sharp cornered crystalline particles of carbonate



of lime, the so called otoliths or stones of the ear, are situated adjacent to the nerve threads; and, also, a bundle of filaments to one end of each semicircular canal, where between the terminal nerve threads a large number of exceedingly fine, sharp pointed elastic bristles grow up.

Waves of sound emanating from a sonorous body and propagated through the air are caught up by the outer ear and strike the outer membrane of the drum. Through the series of bones, the vibrations are transmitted and concentrated on the oval membrane, or inner membrane of the drum. Each movement of the oval membrane is transferred to the water of the labyrinth, and this transmits it to the membranous labyrinth and *ductus cochlearis*, where the nerve terminations are spread out. The greater the intensity of sound, the greater will be the extent or width of the vibrations received by the outer drumhead and finally transmitted to the nerve; the longer in duration the sound, the longer will be continued the vibrations conveyed to the nerve; we are therefore able to become conscious of degrees of loudness and durations of sounds. A noise, that is, non-periodic vibrations, excite the vestibular nerve; if evanescent, they are accepted and prolonged by the otoliths, which vibrating mechanically excite the adjacent nerve filaments; if continuous they are taken up by covibration of the bristles and thns conveyed to the nerve. Just as the untouched tuning fork or piano string is thrown into covibration in sympathy with a sound of the precise pitch to which it is attuned, so each of the microscopical fibers in the *cochlea*, being attuned to particular pitch, responds by sympathetic vibrations to the vibrations emanating from a corresponding tone and from that tone only.

"Within the ears of men and without their knowledge and contrivance" this harp of many thousand strings "has existed for ages, accepting the music of the outer world and rendering it fit for reception by the brain." For the motion mechanically excited in the nerve substance of either the vestibular or *cochlear* nerve is conveyed along the nerve fiber (probably somewhat as electricity is conveyed along a wire) to the brain; and here the physical effect of the motion—nerve excitation—is mysteriously transmuted into the physical or intellectual state of perception—consciousness of sound.

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Visit to a Saw Manufactory.

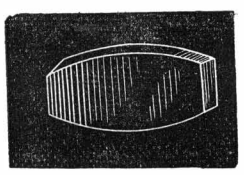
To the inexperienced observer a wood saw is merely a notched steel plate, of no particular character or design, and least of all does it occur to him that it requires any special knowledge or skill to make one. This impression would be speedily dispelled if he visited a workshop where such tools are made; he would then discover that no amount of labor is too great, research or study too severe, to be expended in improving and advancing the character of this simple implement. We recently went through Disston & Son's saw factory, employing one thousand men. It is said to be the largest of its kind in the country, and the various processes there witnessed were so interesting that we propose detailing them to some extent, so that our readers will have clear ideas of the amount of labor necessary to produce a saw.

In this factory all the processes are carried on, from the raw material to the perfect tool. The steel is melted and cast into ingots. Sheets are rolled therefrom, and all the various operations necessary and requisite to fit it for its duty are performed; so that, when it is finally pronounced good by the inspector, it is ready to go to the hands of the mechanic.

THE STEEL.

Saw blades cannot be too good; the various operations they have to pass through "punishes" the steel so much, so to speak, that unless it is entirely uniform in quality, and homogeneous throughout, it will never be satisfactory, or do good service; therefore in this concern the proprietors make their own, so that they can be sure of its quality.

The process of making steel is so well known in general to our readers that we will merely say it is here melted in crucibles as in all other steel works, and rolled into sheets subsequently. The ingots for cross cut saws are of peculiar shape, however, like the sketch, and after being cast are subjected to a thorough forging under heavy hammers to render them tough and uniform throughout. Circular saws are also formed from ingots varying in weight from ordinary sizes up to 300 pounds. These are forged out under very heavy steam hammers, and subsequently reduced to the proper thickness by rolling in the ordinary way. After being rolled, they are laid out and brought to the proper size and then straightened into perfectly flat disks. This straightening is an art, or a branch of the art, peculiar to itself, as any inexperienced person can readily discover by undertaking to straighten, or "take the buckle out," of a piece of sheet metal. He will straighten one edge and make the other crooked, or the center will bulge out; in short, all his labor comes to nought, for the more he hammers it injudiciously the more mischief he does, and he will acknowledge that there is skill and judgment required for so apparently simple an act as straightening a saw plate.



Toothing the saw, in the case of the circular and larger blades, is done under a hand press by punching them in an obvious manner; but with the ordinary carpenters' saws, and those for wood sawing, the teeth are cut in a machine with extreme rapidity. They are fed through in front of a rapidly revolving cutter, at a certain speed, which nicks out one tooth at every revolution, so that the rapidity with which the teeth are made is marvelous to the uninitiated. The attendant stated that the average rate was about twelve saws per minute.

TEMPERING AND OTHER PROCESSES.

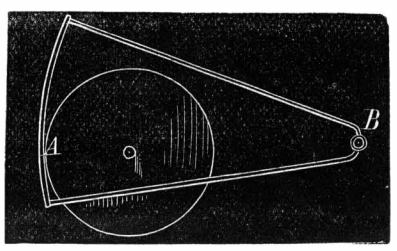
When the saw blades have been passed through the necessary processes previously, they are tempered, ground and polished. The hardening is done by plunging the heated plates into oil baths. The tempering is quite a different and distinct operation, and one extremely interesting in all respects. The thin plates leave the oil baths at a vitreous hardness, glass hard in fact, so that when struck over an anvil they will fly into fragments. This quality has to be taken from them and the requisite elasticity and toughness imparted instead.

Further, when the blades come out of the oil baths wherein they are hardened, they are more or less buckled or crooked, some of them much more than less, and any one but an expert would say that the material was spoiled; but this defect is soon remedied. The hardened plates are removed to a burning fiery furnace quite as uncomfortable as the one of old wherein Shadrach and his brethren tarried awhile. In this furnace there is a cast iron disk made perfectly true on its upper face and supported by a vertical shaft. This shaft is capable of being raised and lowered with the die by a hydraulic ram beneath. Over this die is another—the two constituting a pair of highly heated platens, or hot press. When the die is hot enough, the previously hardened saw blades are placed on it, a dozen or so at a time, and the two are brought together with a force of six tuns, which has the effect not only of drawing the temper of the blades to a proper degree of toughness, but also of taking out all the warp and curl, so that they are to the uninitiated observer "good enough;" they are not good enough for the critical workmen, however, who show you that, although apparently correct and true, they are still far from perfect.

The plates leave the hot dies of a dull dead black, and have to be polished and otherwise brought to a better finish. The polishing is done with emery, in machines or rubbers with a reciprocating motion which imparts that fine straight grain observable in the blades. This operation also has the effect of taking the spring out of the blades, so that, if bent or twisted by accident in using them, a permanent injury would result. They are therefore put through another process, which is merely heating them, in an oven, to a straw color. This restores all the stiffness lost in polishing and handling them after they were tempered. The color put on them in the oven is removed by washing them with acid. After this they are immersed in an alkali to destroy the effects of the acid, dried in sawdust and handed over to the handlers.

These are briefly and superficially the processes which the ordinary hand saw goes through before it is ready to use. We have not attempted to describe them in detail, as it would occupy too much space. The actual routine is as follows: The blade taken in the ingot of steel is first rolled into sheets, trimmed into shape, toothed, filed, hardened, tempered, straightened, ground, hammered, drawn, polished, blocked, rubbed, set, stiffened, sharpened, handled, inspected and sold: nineteen separate and distinct operations, requiring care and experience before it comes to be handled. We may say here what we omitted to say previously, that the temper imparted in the factory under notice is simply exquisite. The old "Toledo blades," so much vaunted, may no longer be held up as models of excellence in this respect. "As fine as an American saw" must hereafter be the standard of comparison. A thin steel ribbon, like a sword blade, may indeed touch heel and point and be nothing extraordinary after all; but when it comes to a saw blade only thirty inches long and an average of five inches in width, to temper this so that it will touch heel and point is indeed a feat worthy of notice. Not a feat, for that implies something out of the common; whereas in these saws the boys took any one of them indiscriminately and drew the foot across the blade, bending it heel to point, and exhibiting it after this severe strain without a curve or a crook in it.

Circular saws are ground as they are used in the mill. They are suspended vertically and ground on both sides at once, the other processes they pass through being identical with those previously described. Mill and cross cut saws are ground on a curious looking apparatus which is in fact a quadrant. The saw is held on the arc of the quadrant, as at



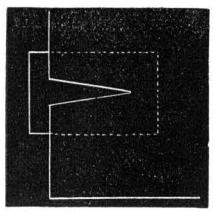
A, which receives a vibratory motion on its axis, B, by suitable mechanism, and the stone revolves against it, having, in addition, a sidewise motion imparted, so that it travels across the face of the saw, making it wholly equal in all parts.

The handles are made of domestic woods, chiefly beech and apple, and are first sawn out on a belt saw and afterwards rounded, rasped, and bored in a manner that will be readily comprehended by most workmen. There is nothing in this department worthy of special comment.

About twelve thousand dozen saws, chiefly hand saws, are made in this establishment per week. This vast quantity goes all over the United States and elsewhere. We were not told at the factory that English goods had been driven out of the market by the American manufacturers, but we were so informed elsewhere. And we can readily believe that, if one saw factory makes twelve thousand dozen per week, to say nothing of a number of others in the business in this country, the demand is enormous.

A useful suggestion for a book mark: A piece of card should have two cuts, meeting at an angle thus:

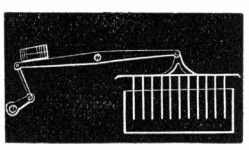
It should be inserted at the fore edge of the book, and will then be thus: and will point to the place desired to be marked.



A Rapid Evaporator.

S. suggests, for rapid evaporation at a low temperature, an arrangement using the principle of the bellows for displacing the air charged with vapor.

A pan (a large shallow one is preferable) with a cover suspended from a horizontal lever, the lever moving vertically on a pivot at or near the center, is to be arranged with the other end of the lever weighted to counterbalance the cover and the blades. The blades are flat pieces of board or metal, as near together as may be desired, attached to the cover along its whole length and breadth and hanging from it, side by side, extending to the bottom of the pan when the cover is down; when the cover is lifted up, they are lifted with it, covered with the fluid; at the same time, the air is drawn in to fill the spaces and is expelled again, as the cover descends, charged with vapor, which, being heated, rises outside, giving fresh air. The lever, worked with a crank, requires little power on account of the weight which counterpoises the cover and blades.



THE crude ammonia salts resulting from the purification of coal gas are frequently found to contain sulphocyanates which render them unfit for manure. In some cases the amount of sulphocyanate of ammonia present was sufficient to destroy the crops where it was applied

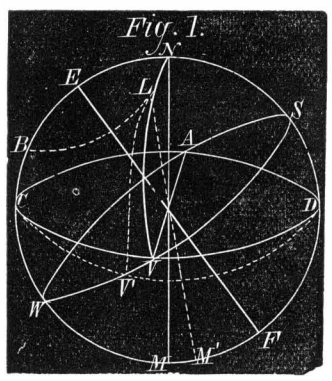
Correspondence.

Retrograde or Direct Motion of the Sun.

To the Editor of the Scientific American:

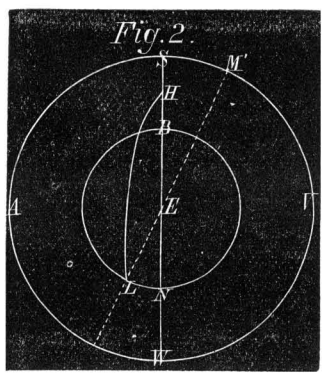
After carefully perusing the article, under this title, in your issue of March 15, I come to the conclusion that your correspondent is wrong in some of his views. He has confounded the effects of precession on the duration of the seasons, with that on the apparent motion of the stars. I will try to make the difference apparent. Let the circle, V S A W, represent the ecliptic whose poles are E, F, and the circle, C V D A, the equinoxes whose poles are N and M; then the circle, N D M C, will represent a solstitial colure. If we suppose that the sun's apparent path, starting from V, is toward S, then V will represent the vernal and A the autumnal equinox. V is continually advancing toward W, a direction opposite to that of the sun, at a rate equal to an angle of 50·1″ (subtended from the center of our figure) per year, causing the sun to reach the equinox 20′ 19·9″ sooner than it would if the equinox had remained stationary. The tropical year is thus made shorter than the sidereal by 1 in 25868.26 + ; and were our civil year dependent on a complete revolution around the sun, instead of the return to the vernal equinox, the seasons would go the whole round of the year in 25,868 years. This is the effect that precession has on the duration of the seasons. But when V has reached V′, N will have arrived at L, travelling toward B, completing the circle in the same length of time.

Fig. 1.



Now in Fig. 2, suppose E to be the pole of the ecliptic, N the pole of the equinoctial, and H a star anywhere outside the circle, N L B. A meridian of the earth, at N, would come under the star again after one complete rotation of the earth on its axis, if N were at rest; but when N arrives at L, the solstitial colure will have taken up the direction L M′, so that a meridian of the earth, again coming to it, will be beyond the star at H. As time accumulates, this difference will increase until, the pole, N, having made a complete revolution around the center, E, the star H will have failed to come to the meridian once, thus losing one day in 25,868 years. This latter is the effect of precession on the apparent motion of the stars.

Fig. 2.



The retrograde motion of the equinoxes is real, and does not necessarily involve the idea of a direct or other motion of the sun, as your correspondent claims. In reality that luminary is nearly stationary as regards the earth. Indeed a motion of the sun from perturbation or any other cause could not take place without sharing such motion with our planet, because, the earth being held in place with respect to the sun by force of gravitation, this force would exert the same influence whatever position the sun took up. C. H. B.

St. Elie, Canada.

The Atmosphere and the Milky Way.

To the Editor of the Scientific American:

Perhaps the following remarks, on the possibly new question of the effect of the atmosphere in causing the apparent course of the Milky Way to vary, may be of some service to science, and particularly in the branch of meteorology. First let me draw attention to what the late Dr. Dick says with reference to the course of this grand nebula in the heavens. In his "Celestial Scenery," he observes that "about the middle of August at nine o'clock in the evening, it may be seen stretching in an oblique direction over the heavens, from northeast to southwest; and its apparent motion along the heavens may be traced with that of the other constellations. At other seasons of the year and at other hours of the night, its position will appear somewhat different." During the winter season of 1871–2, distinguished as it was by great atmospheric disturbance and snowy vaporous charged air, during many days, (from the month of December, 1871, through January and February, 1872) I did not fail to remark that the S. W. end of this great nebula had moved in the arc from S. W. to W., thence to N. W., until finally, in the first week in March, it pointed nearly north, and the other part, nearly south; in other words, this nebula laid apparently across the heavens from north to south. Further, the northern end assumed, in March, a decided sharply defined and brilliant aspect. The apex of the arch was very much bent to the west; and there followed (whether by coincidence or otherwise is the question) a succession of northern and easterly winds both before and after the great gale of March 18, when the barometer was down to 27·90. Sailors regard (and rightly I believe) the dimness or brightness of the southwest branch of the Milky Way as an indication of the quarter whence wind is coming, so the remarkable phenomenon is that the nebula becomes a celestial barometer. This year

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the Milky Way is apparently pursuing the same course, laying by last observation about north and south; but it is more dim and milder in appearance than it was last year, and the weather has followed these indications.

May I suggest that, as the atmosphere is more disturbed, a disturbing effect appears on the apparent course of the Milky Way? We know that water will cause an oar or stick put into it to appear as if broken; so that it may be that the atmosphere laden with aqueous and snowy matter, in suspension but not always positively visible, will exert a like effect. The question is an interesting one.

Halifax, Newfoundland. DELTA.

A Test for Phrenology.

To the Editor of the Scientific American:

Scientific tests are now all the rage, and are applied to a locomotive boiler as well as to a plowman's prayer; I therefore venture to lay before you a test for phrenology, which I believe to be both novel and scientific. Its infallibility rests on the fact that the brain of man, as well as his body gives off more heat when in a state of activity than when in a state of rest; and that this surplus heat can, and has been, measured in both instances by means of the thermo-electric multiplier. The *modus operandi* is as follows: you get a subject, or a patient, or what is better, a person who is willing to be both, and set him to read a novel, or to do some light work, such as shelling peas, etc., which requires no thought or exercise of brain power. You then apply a delicate thermo-electric pile (which is connected with a multiplier) to one or more of his bumps (having previously seen that there is no local inflammation of the parts). You then carefully note the degree of heat shown on the multiplier in each instance (say of the bumps of imitation and constructiveness). This being done, you set the subject to copy a drawing or some writing, and again apply the electric pile to the bump of imitation. Now if the instrument shows an excess of heat above that noticed in the first instance, or even if it shows any excess of heat, in the particular spot known as the bump of imitation, above that of the surrounding bumps: I think, sir, that we may conclude that phrenology is not altogether a farce, and that the bump in question is the seat of the greatest activity in the brain during the action of imitation. We can also try the bumps of constructiveness and amativeness by setting the subject to write a love letter or the bumps of veneration and calculation by setting him to say his prayers and add up a row of figures. If you think there is any difficulty in getting the subject to be patient and tractable under the test, I advise that he be mesmerized before proceeding. I have not tried the experiment myself, but I think that some of your scientific readers may be induced to pursue the investigation, the results of which, I feel confident, would be interesting, not only to the readers of the SCIENTIFIC AMERICAN, but to the world at large.

San Francisco, Cal. G. D.

Ignition by Steam Pipes.

To the Editor of the Scientific American:

I understand the question at present under discussion to be whether pipes containing saturated steam can ignite wood, and not, as E. R. Dingley in your last issue puts it, will superheated steam fire inflammable substances.

He says that he ascertained by the indicator that (as might have been supposed) his Howard sectional boiler was working over water, and he therefore attached a superheater, with which he succeeded in setting the building on fire. Nothing could be more natural than this, for common prudence would have suggested covering the pipes with non-conducting cement and removing all wood work at least 2 inches, by which precautions perfect safety would have been insured. M. M., of Franklin, Mass., (in the same issue) also falls into error in supposing that he was using saturated steam, when, in fact, his upright tubular boiler might (especially when the outflow of steam was partially checked) superheat the steam enough to ignite thoroughly dried or charred wood. Superheated steam is highly economical and advantageous, as is proved by its extensive use in many branches of manufacture. Like other heated substances it must not be taken where it may do damage; but the adoption of the safeguards before mentioned render its use perfectly safe and easy.

In my own practice, and after careful inquiry, I have failed to obtain an authenticated instance of wood burned by saturated steam as ordinarily used, its only effect being to render the wood dry and more liable to ignition by a spark.

New York city. HENRY W. BULKLEY.

To the Editor of the Scientific American:

I have read two articles in your paper relating to ignition of wood by steam heat. I have used steam for years to dry gunpowder; our dry house is arranged with four lines of pipes running upon three sides. The powder is placed in trays, which are set one upon another, reaching from six inches from the floor to the ceiling. It cannot be moved when dry without dust, which arises and of course settles upon the pipes. We have no knowledge of an accident ever occurring from ignition in fact, powder has been often placed upon steam pipes in our engine room (when the pipes were the hottest) to test it. There is not heat enough to explode it. SUPERINTENDENT MIAMI POWDER COMPANY.

Xenia, O., March 14, 1873.

Quartz Mining in California.

To the Editor of the Scientific American:

The quartz ledges or veins of California are from 1 inch to inches in width, some of the wide veins being very rich, producing quartz that will yield fifty dollars per tun. In the stamp mill process, if water power is employed for pumping, hoisting and milling, quartz that will yield three dollars per tun will pay expenses; quartz that will pay ten dollars per tun is considered good rock, and, if mined and milled with economy, will pay a dividend to the stockholders. Quartz is mined in the same manner as lead and copper ores. A shaft is sunk in the ledge to any desired depth and drifts or levels are made at every 60 or 100 feet. Those levels are run, if the quartz will pay, to the boundary line of a claim. The quartz when hoisted to the surface is dumped in the mill house and broken into small pieces about the size of a man's fist. It is then fed into the mill which crushes the rock fine enough for it to pass through a screen of about one hundred holes to the square inch; water is fed into the mill with the rock, and, with the rock when crushed, finds its way through the screen. As soon as the water and quartz sand leave the screen, they pass over electro-silvered copper plates, which are about 13 inches wide and 25 feet long for every five stamps in the mill. These silvered plates are first cleaned with sulphuric acid and then coated with quicksilver; and as the water and quartz sand pass over the plates, the gold adheres to the quicksilver, and the sand and water run off into a concentrator, the office of which is to separate the quartz sand from such fine particles of gold as do not adhere to the plates, also to separate the base metals, if any. Quicksilver is fed into the mill with the quartz and water in quantities to suit the richness of the rock. The quicksilver and gold adhere to the silvered plates and are allowed to accumulate until a thickness of from one sixteenth to one quarter or one half inch is reached. The amalgam is taken off with pieces of hard rubber, and then retorted; after which the quicksilver can be used again, and the gold is ready for the mint. GEORGE PHILLIPS.

Alleghany, Cal.

Alligator Dentistry.--Cement for Setting the Teeth of Alligators and Other Purposes.

To the Editor of the Scientific American:

Having accidentally used a cement which may be new and of value to some of your readers, it gives me pleasure to offer it in return for the many valuable hints I receive from your journal.

Being desirous to preserve as a curiosity the skull of an alligator of uncommon size, I found, to my regret, that, after boiling the flesh from the hideous thing, all the teeth dropped out. The only two substances at hand which seemed to be adapted to the purpose of resetting them were sulphur and beeswax. On trial, however, neither of them would answer. The sulphur was too brittle and the beeswax too soft. It then occurred to me to combine them, and the result was a cement admirably adapted to the purpose. I used half of each ingredient, but it may be made harder by using more sulphur, or softer by using more wax. After pouring the melted compound into the cavity and replacing the tooth, it became perfectly solid and fast in a few seconds, without cracking or shrinking.

It is a beautiful material for taking the impressions of medals, and can no doubt be used in the arts in many other ways. Judging from the ease with which it is cut with a knife, the substance, in proper proportions, can doubtless be turned in a lathe and polished.

The alligator was 14 feet long, the skull, 23 inches long and 13 inches across the jaws at the widest part.

Powhatan, La. WM. W. BLACKFORD.

Construction of Dwellings.

To the Editor of the Scientific American:

I notice in your issue of March 22 a communication signed J. H. L., Cincinnati, O. From my experience I can say that the idea is a good one, if he will make one addition which is very simple.

In filling between the scantling, I place and nail fast at each end a piece of inch board, after having laid up about sixteen inches of bricks; bats or halves will do. These pieces may always be found about a new building, and the rougher they are, the better. The pieces should be nailed flush with the brick and scantling. A. W. BOUCHARD.

Cincinnati, O.

To the Editor of the Scientific American:

On page 180 of your current volume, J. H. L. recommends his style of building for others to follow. Having had experience in building during the last thirty years, I would advise them not to do it, for the reason that the studding will shrink unequally with the filling-in, and cause the walls to crack where the wood and brick join. Let him fur out the studding half an inch and lath so that the key of the plaster joins the filling in. That will prevent the rats and mice getting in.

Morrisania, N. Y. J. G. M.

Vermin in Grape Vines.

To the Editor of the Scientific American:

It is a common complaint in this city that grape vines are so infested with worms as to spoil the crops of most years. I was so troubled until last year, when I determined to rid myself of this pest.

I obtained from a cigar manufacturer two handfuls of tobacco stems, upon which I poured a quart of boiling water. When cool, I applied the liquid to the infected buds, young leaves and embryo fruit, copiously, by means of a syringe which I constructed of a piece of tin tube with a perforated end soldered to it, and a wooden rod packed with flannel and worsted to form a piston,

In consequence of the above treatment, I had an unprecedented crop of grapes last year, as was also the case with my neighbors who followed my advice, and I have no hesitation in recommending it as an infallible cure for worm in the vine. ALEXANDER DOUGLASS.

The Bars at the Mouth of the Mississippi.

To the Editor of the Scientific American:

I suggest the following plan to get rid of the bars at the mouth of the Mississippi: 1. Let the bars take care of themselves. 2. From the nearest point of the river to deep water, run a broad ship canal to the Gulf, and provide it with a lock to prevent the river using it as its channel.

Terre Haute, Ind. J. A. VRYDAGH.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of December, 1872, and January, 1873:

During the months of December and January, there were 2,101 visits of inspection made, and 4,111 boilers examined—1,576 of these were carefully examined internally, and 322 were tested by hydraulic pressure. The number of defects in all discovered were 2,272, of which 515 were regarded as dangerous. These defects were as follows:

Furnaces out of shape, 128—37 dangerous; fractures, 233—120 dangerous; burned plates, 124—60 dangerous; blistered plates, 335—50 dangerous; accumulation of deposit, 492—43 dangerous; incrustation and scale, 470—38 dangerous; external corrosion, 128—12 dangerous; internal corrosion, 52—10 dangerous; internal grooving, 53—4 dangerous; water gages defective, 87—17 dangerous; blow-out defective, 61—13 dangerous; safety valves overloaded and out of order, 67—20 dangerous; pressure gages defective, 213—30 dangerous; boilers without gages, 55—9 dangerous; deficiency of water, 16—12 dangerous; broken braces and stays, 75—36 dangerous; boilers condemned, 31.

The defects enumerated above are such as are usually found in these reports. Boilers that are not carefully watched are liable to rapid deterioration. It must be remembered that boilers are under heavy pressures—that there is an internal force contending continually with the surrounding iron for the mastery. Irregularities and disturbances favor the internal force, and weaken the surrounding resistance. Hence it becomes of the utmost importance that the safeguards of the boiler be kept, as near as possible, in perfect condition.

The neglect to do this is often followed by serious consequences. A case has recently come under our notice, where an engineer (?) was running a boiler with the gage cocks entirely stopped by incrustation and corrosion. The water gage connections were filled up so as to render it worthless, and the safety valve was in a very dangerous condition. In another case, the safety valve was so near the timbers of the floor overhead that it could not lift. Numerous cases of broken and loose braces and stays have been found. In one case, when the boiler was working under a very heavy pressure, the front head was cracked (the stays being broken), and, at every revolution of the engine, it vibrated to the varying pressure. Blisters have been numerous, though in comparatively few cases dangerous; but some have been very bad indeed, and the thin leaf that resisted the internal pressure was saved only from its small area. Pressure gages have been found in very unsafe condition, their variations being from —57 to + 13. The great variations have been found principally in iron works. The worst cases were as follows: —10, —15, 30, —35, —57. These, it will be seen, are all heavy. Hence the steam users were running a pressure, in excess of that indicated by their gages, corresponding to a pressure indicated by the addition of the above errors. Thus, we will suppose that a steam gage, indicating 80 lbs., upon being tested is found to be —57 lbs., or 57 lbs. heavy. It will be seen that the actual pressure would be 137 pounds, which doubtless would be beyond the limit of safety.

The comparatively numerous explosions of steam boilers in iron works and rolling mills, the past year, would seem to indicate that there was a great want of proper attention to the condition of boilers on the part of both proprietors and engineers.

We were recently called upon to test and correct a steam gage which was used on a boiler exposing many lives. The gage, upon examination, was pronounced worthless and condemned. Its variation at 20 lbs., 15 lbs. heavy, and the error increased as the pressure was increased. Upon investigation, it was ascertained that the boiler was in a very dangerous condition. It had been condemned by an inspector nearly a year previous, and yet had been kept at work at an indicated pressure of 60 lb.—or an actual pressure of between 80 and 90 pounds. We regard this a case of criminal carelessness.

Hydraulic Apparatus for Store Shutters.

A plan for closing store shutters by hydraulic power has recently been invented in France. The shutter, composed of horizontal iron laths, is suspended from below on two chains, one of which, after passing over a pulley, supports a piston moving in a hydraulic cylinder. By turning a cock, the water flows from under the piston, which, by its excess of weight, raises the shutter. When the reverse operation is performed, the cock is turned so as to admit the water in the lower part of the cylinder, the piston rises and the shutter falls.

THE first public library at Rome was founded in the year 167 B. C.

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SCIENTIFIC AND PRACTICAL INFORMATION.

MINE VENTILATION.

Mr. G. L. Scott has placed a new plan for mine ventilation in successful use in Wales. The arrangement consists of a number of plain iron cylinders placed laterally to the upcast shaft, which is sealed, and applying a steam jet to each cylinder, on the plan of the injector.

A WATERFALL IN VENEZUELA.

Mr. Brown, the government surveyor in British Guiana, has recently discovered, near the head waters of the Massarund, what appeared to be an immense river descending bodily from the N. W. fall of the great precipice of Reraima mountain. The summit of this cliff is known to be 2,000 feet in hight, and the river, after tumbling sheer down that enormous wall, rushes over a glacis of about 3,000 feet at an angle of not less than 46°. According to the Indians, the fall belongs to the Caruni river, a tributary of the Orinoco, and is in the territory of Venezuela.

THE TEMPERATURE ABOVE THE CLOUDS.

M. Tissandier states that in a late balloon ascent from Paris he reached a hight of 6,560 feet above the earth, where, having passed through layers of clouds, he found a bright sunlit sky and a temperature of from 63° to 65° Fah. When descending and re-entering the clouds, which were in a highly electric state, the temperature decreased to 27°, and the balloon was surrounded by small crystals of ice.

A NEW AGENT FOR DESTRUCTION OF HAIR.

Professor Böttger states that sulphhydrate of sodium is now acknowledged as an agent destructive of hair. This sulphhydrate of sodium attacks the substance of the hair still more energetically than that discovered by him thirty-four years ago, the nauseous sulphhydrate of calcium with the odor of sulphuretted hydrogen. This new agent can be readily obtained in a very convenient form by rubbing together intimately 1 part by weight of crystallized sulphhydrate of sodium with 3 parts by weight of fine purified chalk (carbonate of lime) to a fine powder. By moistening this mixture, which keeps for an unlimited length of time in well closed glass vessels without suffering decomposition, with a few drops of water to a thick paste, and placing it in a layer of the thickness of a knife back upon a hide covered with hair, it will be seen that the thickest hair is changed within a few (two or three) minutes into a soft mass easily removed from the skin with water. By prolonged action the skin itself begins to corrode.

TESTS FOR FUSEL OIL.

A practical and reliable test for this extremely poisonous substance, which sometimes contaminates spirituous liquors, is so desirable that we are not surprised at the number of tests which have been proposed. The following are two of the principal ones: M. Bouvier proposes putting a few pieces of iodide of potassium in a long test tube containing alcohol, slightly shaking it. If the alcohol contains from $\frac{1}{8}$ to 1 per cent of fusel oil, a perceptibly light yellow color soon appears. Professor Böttger, however, showed that many specimens of alcohol which contained no fusel oil still gave this color reaction, owing to the presence of some acid, probably acetic, in the alcohol, which decomposes the iodide of potassium, setting free the iodine. Fusel oil alone, on the contrary, is not able to decompose iodide of potassium even when boiling. A far better test is permanganate of potash, which is much more readily decolorized by fusel oil than by ordinary alcohol.

BISULPHIDE OF CARBON IN ILLUMINATING GAS.

Harcourt has found that, on passing illuminating gas through a pipe heated to redness, the bisulphide of carbon combines with the hydrogen, forming sulphuretted hydrogen which is removed in the ordinary lime or iron gas purifier. A sample of gas which contained 30 grains of sulphur in 100 cubic feet of gas was conducted through a tube heated red hot and then through a purifier charged with oxide of iron. On testing it afterwards, it was found that the amount of sulphur was reduced to 5 or 6 grains in 100 cubic feet. This method of purifying gas seems simple enough, but at present a practical method of performing it on a large scale is wanting.

NEW PROCESS IN STEEL MAKING.

MM. Bajault and Roche have devised a process of steel manufacture based on the partial decarbonization of the iron under the influence of a rich oxide of the metal. This method has been known for some time, but has not been put in practice on account of the deterioration it caused in the sides of the crucible. In the process of the above inventors, the iron and mineral are placed in metallic molds and brought to a red heat in special furnaces. The reaction is produced and the melting does not take place until after the transformation. Ingots are thus obtained, melted in crucibles or in a reverberating furnace.

ACETIC ACID BY SYNTHESIS.

M. Thenard placed in a glass receptacle a mixture of carbonic acid, CO^2, and proto-carburet of hydrogen, CH^2, through which the electric current from a Ruhmkorff coil was allowed to pass. Under the influence of the electricity, the absorption of the gases commenced almost immediately, became more and more marked and finally gave rise to a colorless liquid which could be none other than acetic acid, C^2O^2.

IS THE MOON INHABITED?—A correspondent, N., states his belief that, as man existed on the earth during the glacial period, it may be found that the moon, notwithstanding the intense cold, may be inhabited. He does not consider the fact that the satellite has no atmosphere, and no moisture to sustain vegetable and animal life.

Amateur Cooperage.

Putting a hoop on the family flour barrel is an operation that will hardly bear an encore. The woman generally attempts it before the man comes home to dinner. She sets the hoop on the end of the staves, takes a deliberate aim with the rolling pin, and then shutting both eyes brings the pin down with all the force of one arm, while the other instinctively shields her face. Then she makes a dive for the camphor and unbleached muslin, and when the man comes home she is sitting back of the stove thinking of St. Stephen and other martyrs, while a burnt dinner and the camphor are struggling heroically for the mastery. He says if she had kept her temper she wouldn't have got hurt. And he visits the barrel himself, and puts the hoop on very carefully and adjusts it so nicely to the top of every stave that only a few smart knocks apparently are needed to bring it down right, when he laughs to himself to think what a fuss his wife kicked up over a simple matter that only needed a little patience to adjust itself, and then he gets the hammer and fetches the hoop a sharp rap on the side, and the other side flies up and catches him on the bridge of the nose, fills his soul with wrath and his eyes with tears; and the next instant that barrel is flying across the room accompanied by the hammer, and another candidate for camphor and rag is enrolled in the great army that is unceasingly marching toward the grave.—*Danbury News.*

Longitudinal Rail Support.

Mr. Wm. S. Huntington, in the *Railroad Gazette*, gives the following plan of rail support: He says that a good arrangement is to lay cross sleepers in the ordinary manner (except with a little more care) and place thereon stringers or rail plates, say 8 by 12 inches and of any convenient length, but breaking joints with the rail. The cross ties and rail plates should be of sawn or very nicely hewn timber, to insure a perfect bearing of the plate on the cross tie. The most efficient manner of securing the plates to the sleepers would be to spike cast iron brackets to the sleepers and also to the plates. On very sharp curves it might be necessary to use shorter plates than on straight lines, in order to bring the rail in the center of the plate. With this arrangement it is considered that the sleepers could be entirely covered with ballast, which would render them more durable than when only partially covered. Most kinds of timber suitable for sleepers would remain sound more than twice the ordinary length of time. They would be relieved of the destroying influences of the weather and the rotting effect of contact with the rail. More perfect drainage would be secured, the rail would be held in line, and, if the ends of the plates were placed in contact, all creeping of the rails would be prevented.

Standard Car Journal Bearing and Key.

A committee appointed by the Master Car Builders' Association to determine the most suitable form and size of railway axles, oil boxes and journal bearings, in order that a uniform standard may be adopted, state that larger axles, longer and larger journals and larger oil boxes than are now in use are desirable. A large axle, it is considered, would tend to lessen its liability to break: an increase in the length and diameter of journals would distribute the friction over a larger surface, facilitate lubrication and avoid delays by hot boxes.

The following specified sizes of journals and axles for all new work, both for passenger and freight cars and also for old cars as far as practicable, is recommended. Length of axle between outside collars, 6 feet 10 inches. Thickness of collars, $\frac{5}{8}$ inch. Diameter of axle at wheel seat, $4\frac{1}{2}$ inches. Diameter of axle at center, 4 inches. Length of journal, 7 inches. Diameter of journal, $3\frac{1}{2}$ inches.

The Employment of Women.

L. W. E. writes to dispute some statements in our article on page 97 of the current volume, especially those to the effect that women have lost some of their employment by men invading their avocations, and that women are entitled to some recompense for the wholesale robbery. "Have not these same women robbed editors, clerks, lawyers, physicians and lecturers, about as much as they have been robbed? The statistics of New England show that, while men have devised methods to add to their wealth, the ability of women to earn a livelihood has diminished. If, as is sometimes claimed, woman is man's equal, why does she not devise methods to add to her wealth, or show her ability to fill the clerkships and offices that she so thirsts after?" He asserts generally that women have enough fields of employment open to them, if they will only enter in and labor.

Improved Submarine Lamp.

M. Pasteur has discovered that the vitiated air discharged by divers contains oxygen enough to support the flame of a a petroleum lamp. He accordingly connects, with the flexible escape pipe of a diver's helmet, a suitable lamp of the above description. The lamp may be carried in the hand of the diver or attached to any part of his person. The flow of the escaping air from the helmet through the lamp gives a bright flame, enabling the diver to see in all directions, rendering the employment of the expensive electric light no longer necessary.

E. T. C. says: "some of my brother wood workers may not know that the difficulty of finishing a small piece of green wood, as is sometimes necessary, may be overcome by scorching the piece after it is shaped out. A few lighted shavings will do, and you can then file and sandpaper without trouble."

Ozo-benzine---A New Explosive.

MM. Houzeau and Renard state, in *Les Mondes*, that by causing concentrated ozone to react upon pure benzine boiling at 178° Fah., a solid body is formed of gelatinous appearance to which the name of ozo-benzine has been given. The formula is $C^{12}H^6$ (C^2 6 H^6). Dried in *vacuo*, the substance becomes solid, white, amorphous and highly explosible. It detonates with violence under the influence of shocks or heat. A few grains exploded in the laboratory shattered the glass in the windows. It is very unstable, and when left either in air, carbonic acid, or even in a vacuum, it changes rapidly. Among the products of the aqueous decomposition of ozo-benzine, is noted the presence of acetic and formic acids, and also that of a solid acid, very soluble, becoming colored brown by potash or soda. Another composition is also formed which has an agreeable odor and no acid reaction.

It has also been noted that a mixture of bicarburetted hydrogen and ozone detonates violently without the action of light, heat or electricity. The ozone must be strongly concentrated.

A Texas Invention.

The following letter was received at the Patent Office recently:

To the Commissioner of Patents:

SIR: I will trouble you with the description of an article that I have invented for the purpose of extracting such substances as money from the stomach. If it is not already patented to some other inventor I want a patent. I am the inventor of the instrument that I claim. I was called on by a Dr. ——, who had a patient, a little girl five years old, that had swallowed a half dollar, and it had been in the stomach three days. I went to work and made him an instrument with which he took out the half dollar at the second trial. I know a doctor who says that he was called to a case of a similar kind, and the patient died. I want to know what it will cost to get out a patent and how to go about it. If you will furnish me with the instructions I think are necessary I will go to work at once to complete it. I know that my work is a complete success, and no humbug about it. Please address —— ——, Texas.

A Pneumatic Sewing Machine.

A sewing machine motor, invented in England by Joseph E. Holmes, consists of a sewing machine having, below the table, a train of gear wheels and an air pump, operated by a crank, the pump being used to exhaust the air from a cylinder, underneath a piston which traverses the cylinder. The exhaustion of the air causes the piston to descend and drive the sewing machine. If a vacuum equal to 14 lbs. to the inch can be obtained, the piston being 9 inches in diameter, the pneumatic pressure on the piston will be 890 lbs.; equal to a weight of that amount falling say three feet, the hight of the sewing machine table under which the piston is placed.

This device strikes us as a rather complicated method of applying and storing the power exerted by the individual in turning the crank. The coil spring would be simpler and cheaper. We have seen sewing machines driven by springs that operated well. In fact, we gave an illustration of such a machine in our last volume, at page 134.

The Great Suspension Bridge between Brooklyn and New York.

At a recent municipal investigation into the affairs of the above bridge company, State Senator Murphy, who is one of the directors and subscribers, was examined, and among other statements he gave the following particulars:

The piers are a success. One deflected only three eighths of an inch, and the other five eighths of an inch,—a most remarkable circumstance in such a work. The work cost us a little more than we expected, because of the increase of five feet in the hight ordered by the United States Government authorities. It may cost us $1,500,000, more than we anticipated, that is, for the bridge itself $9,000,000 and land $2,500,000, or a total of about $12,000,000. We have got to take all the land under the works on both sides of the river, but we can utilize it. On the Brooklyn side it would be a splendid place for a market.

Silicic Acid as a Mordant.

It is known that amorphous silica possesses considerable power for absorbing certain colors, especially certain aniline tints. Cotton impregnated with a silicate solution takes color rapidly and permanently. The best means of attaining this result is to treat the cotton with a solution of water glass and then to precipitate the silica in the fiber by means of an acid before placing the cotton in the dye. As regards freshness and beauty of shades, cotton thus prepared is much superior to that acted upon by tannic acid as a mordant. M. Reimann, the inventor of the process, is making experiments in order to fix aniline colors on glass, by previously attacking it with hydrofluoric acid.

ALL new subscriptions to the SCIENTIFIC AMERICAN will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

THE *Spectrum* is the name of a new quarto paper published by the students of the Institute of Technology, Boston, Mass.

THE archer fish, *toxotes jaculator*, supplies itself with food by spirting drops of water at flies, as they rest upon grass stalks on the edge of the stream. The fish seldom fails to hit and bring down the fly at which he aims.

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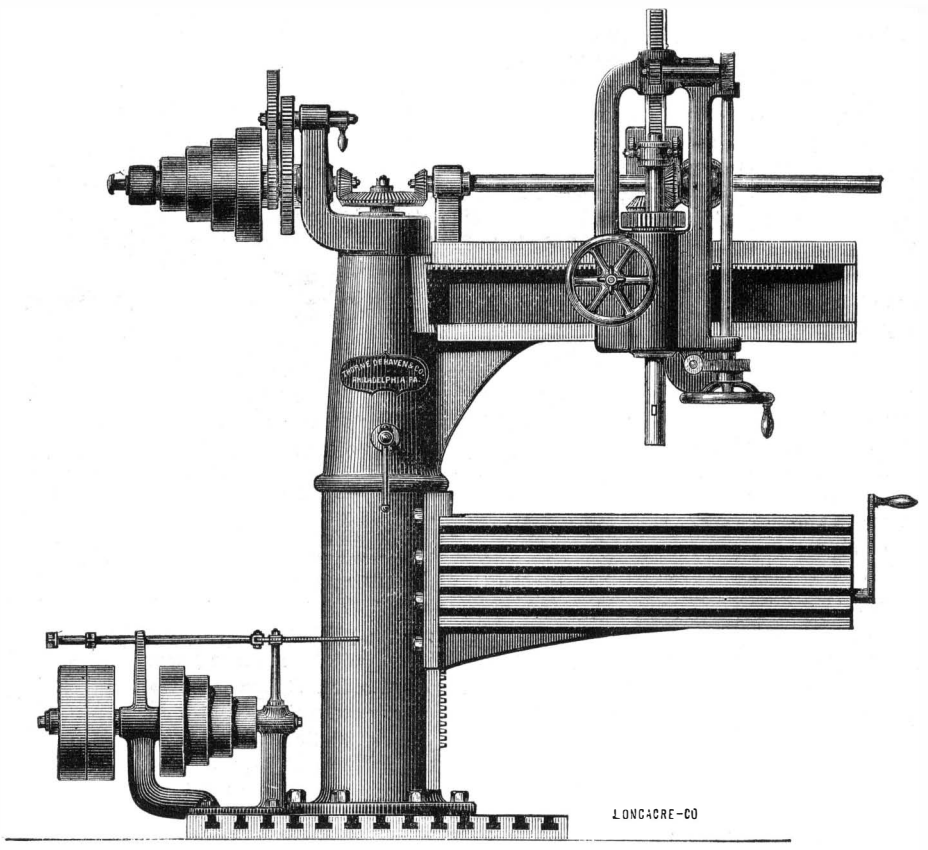
IMPROVED RADIAL DRILLING MACHINE.

The accompanying illustration shows a radial drilling machine, designed and constructed by Messrs. Thorne, De Haven & Co., Philadelphia, Pa., patents for the novel points of which have been applied for. Among the most prominent of its many excellent features are the following

The countershaft is on the base and the driving cone on top of the post, to facilitate changes of speed. The table has T slots on the top and side, and can be raised and lowered to suit the thickness of the work. It is held to the post by V-shaped gibs, thus reducing the leverage on the post when drilling on the table. The saddle carrying the spindle is traversed by a rack and pinion. The spindle is counterbalanced to prevent its dropping, in case of any lost motion, through a hole, before it is quite finished, or into a blow hole, a fruitful source of breaking drills. The feed to the spindle is obtained by a rack and pinion operated by a tangent wheel and worm. There is a self-acting feed with three speeds, which is thrown in by a friction clutch.

It will be seen that means are here afforded for fastening work, in which a number of holes is to be made, firmly to a table adapted to the purpose, and for bringing the drill in proper position for drilling each hole without moving the work. This, it is claimed, can be effected, no matter how small the piece to be operated on may be. The holes are made accurately, and the danger of breaking drills through the turning of the plate is necessarily avoided. The machine is, it is stated, in every respect as stiff and, to a certain degree, in this particular superior to the ordinary stationary apparatus. There is a long thick bearing, where the arm rotates on the post, which effectually prevents any springing, while any amount of stiffness may be given to the table.

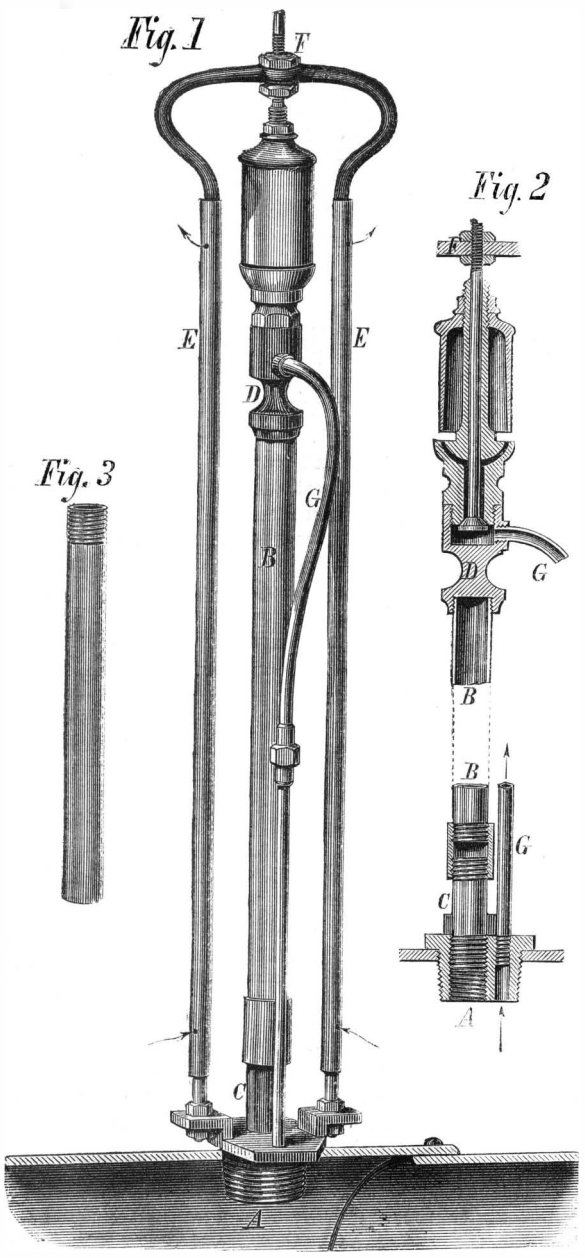
For further information address the manufacturers, 21st street, above Market, Philadelphia, Pa.



RADIAL DRILLING MACHINE.

HIGH STEAM GAGE AND LOW WATER REGISTER.

We present herewith illustrations of a new form of high steam gage, and also of a novel device constituting a low water register. These inventions, though they may be arranged in combination, as will be explained further on, are also constructed and used separately, and we therefore thus describe them:



HIGH STEAM GAGE.

The high steam alarm, Fig. 1, is inserted in the upper shell of the boiler, and communicates with its interior at A. B is a brass tube, the lower part of which is surrounded by a pipe, C, of non-conducting material, and is hermetically closed at D. The alarm whistle is situated as shown, and its valve has an inverted stem, which passes up through it and is secured by the two nuts, F, on the side tubes, E. Through the latter a current of air is allowed to circulate, entering and leaving through the perforations at top and bottom, and in the direction indicated by the arrows. G is a pipe serving to conduct dry steam from the boiler to the alarm.

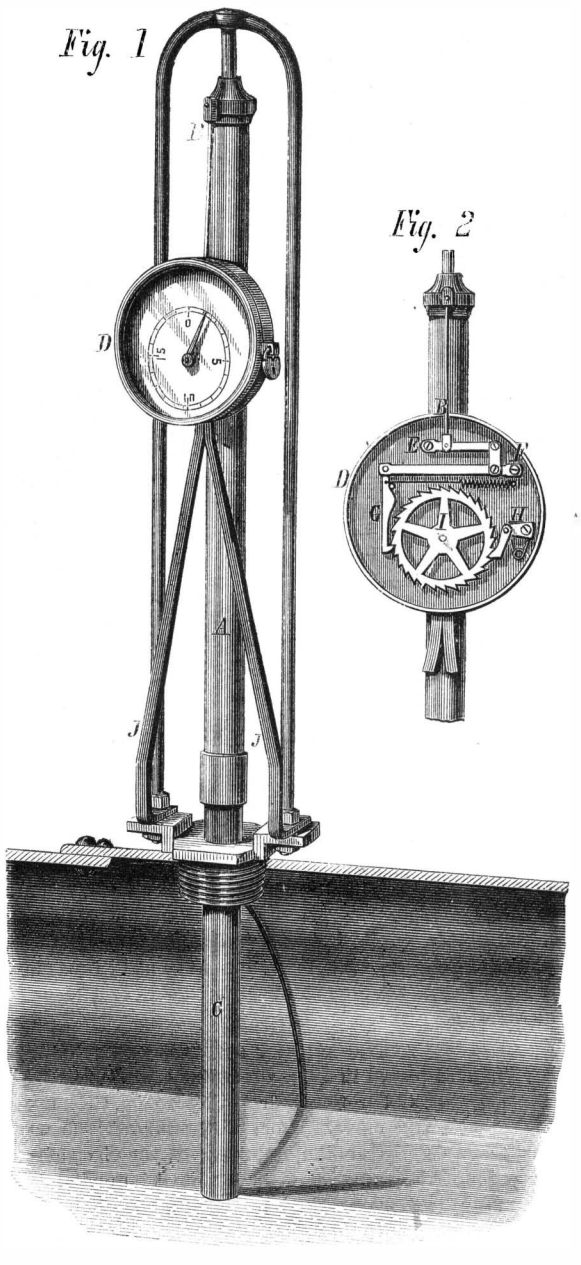
Let it be supposed that the whistle is required to sound whenever the steam pressure exceeds 60 pounds. As the steam is generated, it at once escapes up through the pipe, G, and the alarm blows. The nuts, F, must then be tightened, screwing up the valve until the escape ceases, and this must be continued until the steam gage shows 60 pounds. By this simple adjustment the high steam gage is made ready for instant service, as is evident from what follows. As the pressure of steam increases, its temperature also augments, consequently greater heat is applied to its containing vessel which, if of proper material, proportionately expands. This is the case with the tube, B. As the steam pressure rises above 60 pounds, say to 63 pounds, the tube is caused to elongate, and its upper extremity, rising, carries the whistle up with it. But the valve stem is held rigidly by the rods, E, to which it is screwed, and which do not expand because they are kept cool by the air within them. Therefore the valve seat is raised from the valve and the port opened. Steam from the tube, G, then enters the whistle, which continues sounding until the pressure falls, and the tube, B, contracts. The non-conducting envelope on the bottom of the latter serves to prevent it from being affected by the high temperature of the adjacent parts of the boiler, consequently, the sensitiveness of the tube is measured by nearly the entire expansibility of the metal, instead of the small residue of that property which would otherwise remain. This is an important advantage, and is claimed to obviate one of the principal difficulties encountered in the use of gages based on a similar principle.

In our second illustration, we have a low water register which indicates, by means of a dial and pointer, not only each time the water falls below a fixed level, but also keeps a record of such depressions. It will be seen that this is a sort of tell-tale device which, if placed on a boiler and so arranged as to be unalterable by the engineer, will at once give evidence of not only whether he has been derelict in keeping plenty of water, but how many times he has neglected this duty. In operation the invention is very similar to the one above described. There is an isolated expansion tube, A, Fig. 1, closed at the top, which, however, is here prolonged by a pipe, C, which extends down into the boiler to the desired low water level. D is the indicator dial; B is an iron rod which is suitably fastened to the top of the tube, A. This rod enters the box of the registering apparatus and connects through a series of multiplying levers, E F, with the pawl, G. The latter, as shown, engages with the ratchet wheel, I. H is another stop so arranged as to prevent the wheel turning but in one direction. The pipe, A, is supported and guided during its expansive movement by a pin which extends up from its top and works freely through an orifice in the upper portion of the side rods. This last mentioned part of the device, it will be noticed, is represented as curved, but the experience of the inventor, as well as a careful test which is below referred to, has proved that more advantageous results may be gained when it is made straight. The dial is supported by the rods, J J.

As steam is generated in the boiler, water is necessarily forced up. The tube, A, is thus kept filled until the water in the boiler gets below its lower end. Its contents then run out and steam enters, which, being so much hotter than the water, instantly causes the tube to expand. The register, D, being rigidly held, cannot move, so that the tube, as it rises, pulls upon the rod, B, and thereby moves the levers, E F, which raise the pawl, G, which, in turn, carries the wheel one tooth in advance. This is, of course, indicated by the pointer on a suitable scale on the face of the dial. On the pawl, G, is a cam projection which, when the former is caused to rise still further by the continued expansion of the tube, takes against a stop and prevents the pawl from engaging with the tooth next above. This device prevents more than a single movement of the wheel each time the water becomes low.

The high steam gage can be readily converted into a low water alarm by adding to the tube, B, the extra piece, Fig. 3, and the dial may also be placed in position if desired. As regards the practical utility of these inventions, we annex the following extracts from a report of tests recently made by Professor R. H. Thurston, of the Stevens Institute. This well known expert says, in relation to the low water register, that its action was, in every respect, satisfactory, and then states that, in the case of the high steam gage, he at first doubted "whether it could be possible that the slight change, in the length of the central tube of the instrument, produced by so slight a change of pressure as the inventor claimed, could be relied upon to give an alarm, even were it possible for any change of pressure to do so. I am now willing to report that it will. By repeated experiment I find that, by delicate adjustment of both the whistle and its valve, a change of even two pounds pressure will cause an alarm. . . . . I believe the claims of the inventor to be substantiated by my experiments."

Scarcely a day passes without the news of a more or less disastrous boiler explosion reaching us, and the records of such calamities during the past few months show that in nearly every case the cause of the occurrence is the incompetence or inattention of the person in charge. In such cases, the value of an automatic safety apparatus and an unalterable register becomes doubly apparent; and the inventor of the two devices herewith described has certainly devoted his talent to one of the most pressing needs of the engineering world. The importance of this subject cannot be overrated, as the columns of the SCIENTIFIC AMERICAN, with their sad accounts of death and destruction in all parts of the country, fully demonstrate.



LOW WATER REGISTER.

Patented August 27, 1872. For further particulars address the inventor, Mr. W. S. Belt, Cincinnati, Ohio.

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FLEXIBLE SAW AND TOOTH FILING APPARATUS.

This invention consists in an abrading wheel of emery or corundum, hung upon a flexible frame and set in rapid motion. By means of a handle, it is controlled by the operator, and may be placed at any angle to the article to be filed. The device is especially applicable to the gumming of saws, circular or upright, and the sharpening of molding bits or similar tools.

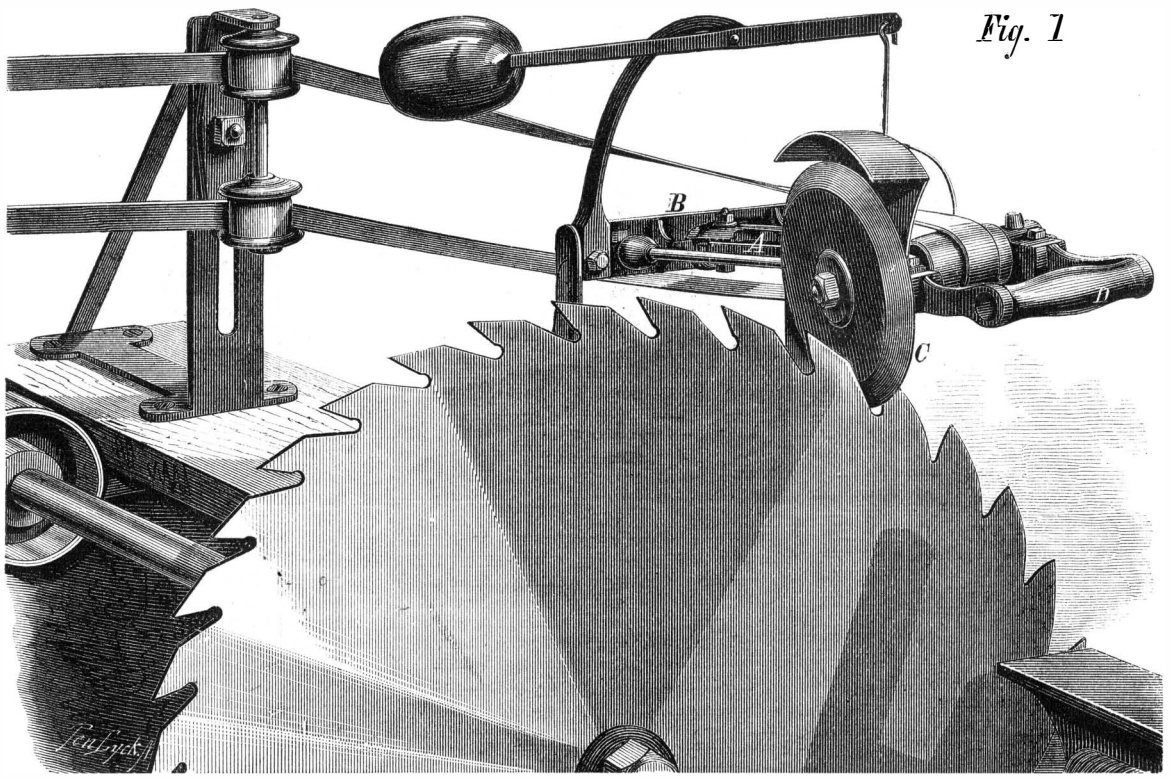
The working portions are composed of a movable frame, A, which, by a ball joint, is hung on the main frame, B, so that the grinding wheel, C, has a universal movement controllable by the handle, D. Still freer motion is afforded by a second joint on the frame, A, or the latter may be so arranged that only a straight up and down or side motion can be imparted to the wheel, which is thus kept square to the work. The lever and weight shown serve to balance the frame and wheel, and so relieve the hand of the operator.

The accompanying illustrations represent the adaptations of the machine to various purposes. Fig. 1 shows it arranged for use in circular sawmills. The apparatus is placed immediately behind the saw upon a plank, on the side where the teeth turn up, the shaft of the emery wheel being in line with the blade. The countershaft is attached to the back end of the plank in a direct line with the driving pulley of the engine. The belt or cord is placed upon the small pulley of the machine, then around the pulleys on the countershaft, turning an angle thence to the driving pulley. The operator applies the wheel, which revolves at the rate of from 1,500 to 2,000 revolutions per minute, to the saw by means of the handle.

Fig. 2 represents the machine as applied to the dressing of muley, drag, or cross-cut saws, and also to circular saws when removed from their mandrels. The appliances for holding the implements are the principal features, and are clearly depicted in the illustration. Fig. 3 shows the apparatus adapted to shaping molding bits or cutters for wood working machinery. The adjustable device for holding these tools is represented at G, in Fig. 4. It can be readily removed from the bar, H, by loosening a set screw. The arrangement shown in Fig. 2, for holding saws, may then be substituted and fastened in place in a similar manner.

Patented through the Scientific American Patent Agency, December 31, 1872. For further particulars address the manufacturers, Messrs. Frey, Sheckler & Co., Eagle Machine Works, Bucyrus, Ohio.

Fig. 1



FLEXIBLE SAW AND TOOTH FILING APPARATUS.

Fig. 2

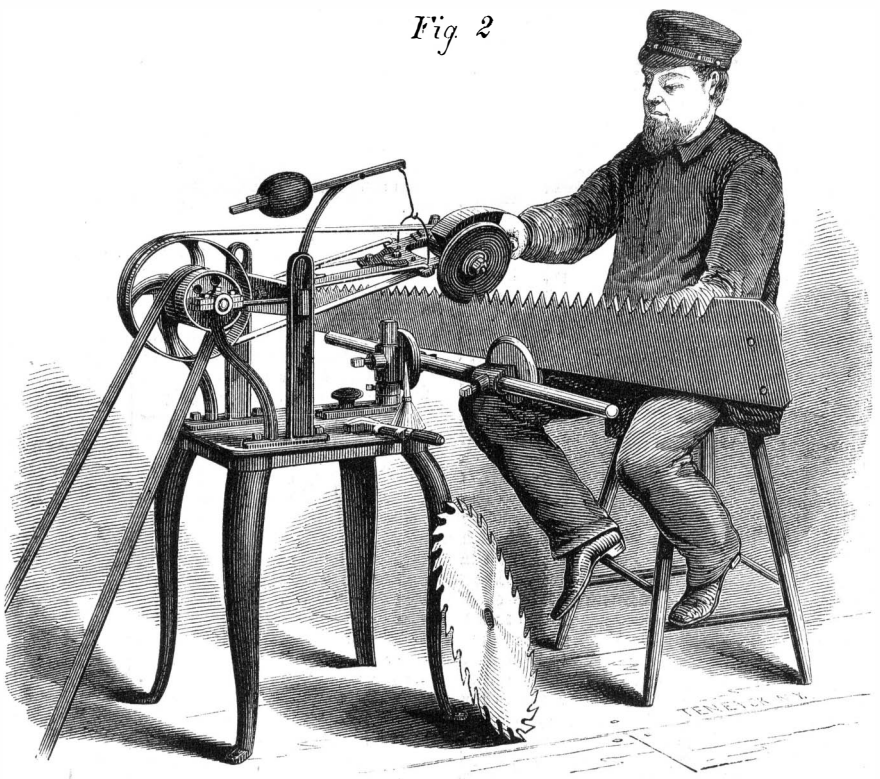
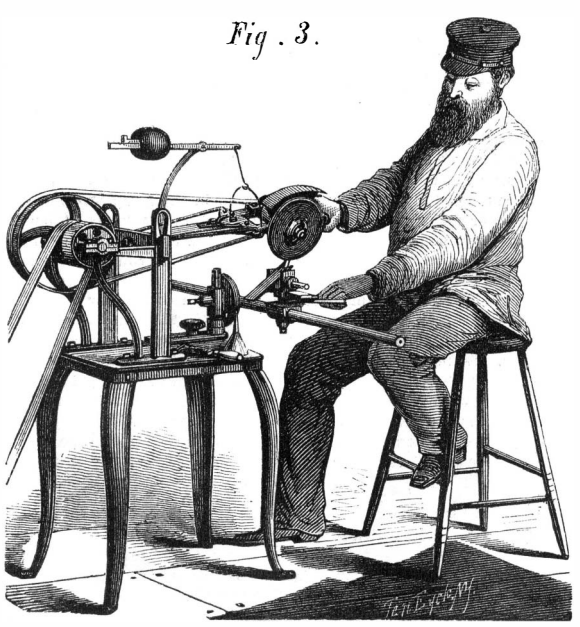


Fig. 3.



A Singular Fire.

A correspondent, A. A. F., encloses the following paragraph from the Cleveland (O.) *Leader:* A hard wood plug had been put into a hole in a gas pipe that ran along the ceiling in our job rooms, several feet from any burner, and in a position where no one could ever suppose it would catch fire. About six inches below it, passed a belt running from one pulley to another, and in operation during the day. About four days after the plug had been driven into the pipe, it was noticed to be on fire, and a bright jet of light, as if from a burner, burst forth from the side of the plug, which was already charred and being rapidly burned up. How the plug caught fire, how a steady flame of light could suddenly burst out from the side of it, was of course a subject of anxious inquiry. No one had lighted it and no fire had been used near it. The only conclusion possible was that it was caused by electricity from the belt, and a full investigation confirmed this conclusion. Had it happened in the night time, it might have enkindled an extensive conflagration, and its origin would never have been known. Many destructive fires may have started in this manner, their causes remaining for ever unknown. It is an incident worth bearing in mind, and proves that too much care cannot be taken in guarding against fire."

REMARKS:—In this case there was doubtless a slight leakage of gas at the side of the plug, and the gas was fired by electricity from the belt, just as our young folks at home ignite gas at the burner by rubbing their feet on the carpet and then approaching the escaping gas at the burner with their fingers.

Man a Republic.

Professor Haeckel, of the University of Jena, may be regarded, says *Nature*, as the most eminent living representative of the doctrine of evolution in Germany. He has won a name for himself during the last ten years as the author of several remarkable works in various sections of natural history. He has adopted out and out the system of Darwin. Indeed, on more than one point he goes much further than his master, and it may with truth be said that he is more Darwinian than Darwin himself.

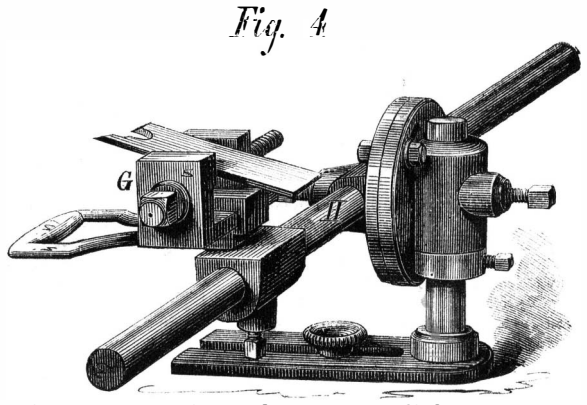
Professor Haeckel has given a *resumé* of his theories as a whole in a series of lectures at Jena, re-published under the title of "Natural History of Creation," in which he gives the following facts concerning the embryology of man:

At the outset of his existence, man, like every other animal organism, is only an egg, a simple little cell, whose diameter is only one fourth of a millimeter—the one hundredth part of an inch—at the most. It differs from the primordial cellule of the other mammalia only in its chemical constitution and the molecular composition of the albuminous matter of which the egg essentially consists. And yet these differences cannot be directly perceived by any means at our disposal; but we are compelled by indirect conclusions to suppose their existence as the prime cause of the difference in individuals. The human egg incloses all the essential elements of a simple organic cellule; a protoplasm which bears the name of *vitellus*, and a *nucleus* or germinal vesicle. This nucleus is a small sphere itself, inclosing another nucleus much smaller still, the *nucleolus;* exteriorly the protoplasm is enveloped by a membrane which is known by the name of *zona pellucida*. The eggs of many of the lower animals, as the greater part of the medusæ, are, on the contrary, naked cells which do not possess this envelope.

As soon as the egg of the mammal is completely developed, it leaves the ovary and descends, by the narrow canal of the oviduct, into the uterus, where, after fecundation, it becomes an embryo. This transformation is thus brought about: The original cellule becomes divided into two cellules: on the primitive nucleolus are formed two new specks, and the nucleus becomes separated into two vesicles, each of which takes with it half of the protoplasm. The result of this process is that, in the heart of the vitelline membrane, which alone is not divided, two cellules are found in juxtaposition, differing from the original only in being unenveloped. Each of these new cellules is in its turn divided into two others, so as to form four, which in the same way become eight, these eight, sixteen, and so on; these successive segmentations producing an agglomeration of cellules, in outward appearance resembling a mulberry. The further development consists in these cells assuming the shape of a sac (*vesicula blastodermica*), in the interior of which a liquid collects; shortly, on a point of the wall which is composed of these cells is produced a disk-like coagulation; their number rapidly increases, and this particular condensation becomes the embryo strictly so called, while the remainder of the blastoderm serves only for its nourishment. The embryo soon begins to broaden into the form of a biscuit. Three leaves or layers of cellules can be distinguished, superposed like envelopes upon each other, and each having its particular place in the construction of the living being; from the exterior leaf is formed the epidermis and the central parts of the nervous system, the spinal marrow and the brain; from the central layer is formed the interior membrane which lines the digestive canal from the mouth to the anus, with all the glands that are attached to it (the lungs, the liver, the salivary glands, etc.); the intermediate layer is the source of all the other organs.

The processes by which the three layers of cellules give birth to the most complicated organs can all be reduced: (1). To new segmentations, and consequently to an increase in the number of the cells; (2). To the divisions of labor or the differentiation of these cellules; (3). To the combination of these cellules, differently developed. The cellules which comprise a living organism may thus be compared to the citizens of a state, some of whom have one set of functions to perform, others another; the division of labor, and the organic perfection which results from it, enable the state to accomplish certain undertakings which would be impossible to isolated individuals. Every living organism composed of many cellules resembles a sort of republic, capable of accomplishing certain organic functions, which could not be discharged by a single cell, an *amœba*, or a monocellular plant. No rational mind would seek to explain by superhuman intervention the public weal which accrues to political society, from the harmony of particular actions; so also in the organism, all the adaptations to ends ought to be regarded as the natural and necessary consequence of co-operation of the differentiation and the

Fig. 4



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perfection of the cellules, and not as the intentional work of a supernatural will.

Until the brain begins to show itself distinctly, it is scarcely possible to recognize any difference between the embryos of the different vertebrata, or at least of the three superior classes—reptiles, birds, and mammals. Why, then, should any one now refuse to admit the most important consequences of the theory of evolution, according to which men have descended from simious or even inferior mammals?

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

REFRIGERATORS.—PATENT.—GEORGE C. ROBERTS *vs.* JOSEPH BLAKE, JR.

SHEPLEY, *J.*:

This is a bill in equity to recover profits and damages for alleged infringement of letters patent granted to D. W. C. Sanford, November 13, 1855, reissued April 21, 1857, and extended October 21, 1869, for an improvement in refrigerators, the interest in the letters patent being now owned by the complainant.

The principal question in the case is as to the novelty of Sanford's invention. *

The claims in the Sanford patent have been fully and clearly construed by the Court in the case of Roberts *vs.* Herndon, 2 Clifford, p. 503. Upon a careful examination of the evidence in this case, I am of opinion that the conclusion of Judge Blatchford in the case of Roberts *vs.* Dodge, in the Second Circuit and Southern District of New York, is correct; that the inventions of Sanford and the claims of his patent are fully anticipated, on the point of novelty, by the refrigerators constructed under Lyman's direction, at the Novelty Works in New York, in 1854.

These refrigerators, including also Exhibit Hedden No. 1, contain the same combination of elements named in Sanford's first claim. There are some slight structural differences. The elements of the combination are somewhat modified in their form, but the combination of the same elements produces in substance all the results and the same results claimed by Sanford.

Bill dismissed without costs.

[*Thomas A. Jenckes* and *Richard Stone*, for complainant.
Carsten Browne and *Jabez S. Holmes*, for defendant.]

United States Circuit Court---Eastern District of New York.

HOSE COUPLING PATENT.—WM. H. BLISS *vs.* THE CITY OF BROOKLYN.

BENEDICT, *Judge*:

This action, which has been before me on a former occasion upon other pleadings and proofs having been reopened, now comes up for determination upon new pleadings and different proofs. It is an action to recover damages of the city of Brooklyn for using certain hose couplings, which are claimed to be an infringement upon a certain patent for hose couplings, originally issued to Robert B. Lawton and William H. Bliss, on the 22d day of February, 1859; reissued December 21, 1869; and now owned by the plaintiff. *

The claim in this reissue, which is the object of this controversy, is as follows:

"The combination of the two thimbles C and D by means of a pin operating longitudinally through the outer thimble C and against the inclined side of the thimble D, so that the two thimbles will be forced together by the inward movement of the pin and be liberated by its outward movement, substantially as described." *

In opposition to the patent as thus reissued, several grounds of defense have been here taken. One of them is that the invention which the reissued patent describes is worthless and the patent invalid; and this defense appears to me to be supported by the proof. The law upon the subject of utility is not in doubt. No particular amount of utility is required to render an invention patentable, but there must be some. When the invention is shown to be worthless the patent must fail. Such appears to be the case in the present instance. The evidence fails to disclose an instance where the combination described in the reissued patent of 1869 has been successfully used. The plaintiff himself testifies that he does not know of any such coupling having been found to be of practical use. Although he sells couplings, he never sold any such, and only recollects three instances where their use has been attempted. His testimony satisfies me that the combination described in the patent here relied on proved inoperative and worthless.

It is true that couplings containing all the elements in combination which are described in the plaintiff's reissue of 1869 are in use, and such are those used by the defendant, but in these couplings another essential element is present in the combination, which additional element is not to be found in the plaintiff's reissue of 1869.

This additional feature is a lug, which is placed upon the inside of the outer thimble opposite to the pin in such a manner that when the pin is forced inward upon the inner thimble the inclined side of the groove of that thimble is pressed upon the lug, and the part of the inner thimble thus forced up to the shoulder of the outer thimble, at the same time that the pin itself, by pressing the inclined groove when it is touched by the pin, forces that side of the inner thimble up to the shoulder of the outer thimble, thus making a tight joint which cannot tilt, although the inner thimble be smaller than the inside of the outer thimble, and which cannot swivel or turn and be tight.

The introduction of this element makes the combination a different combination from that described in the plaintiff's patent of 1869. This combination, in which the lug enters as an element, is the subject of another patent obtained by the plaintiff in 1862, which he has not proved here, and in which he states that the lug is "very essential."

This latter patent of 1862 has been put in evidence by the defense, and it affords strong support to the position that the combination described in the reissue of 1869 proved worthless.

But it is said the introduction of the lug is simply an improvement. I cannot so consider it. The two combinations are distinct, because they have different elements and attain a different result. In the one combination no lug appears, and no practical result is attained. The introduction of the lug for the first time produced a combination which accomplished any useful result. An added element which increases the efficiency of a combination, of itself effective, is of the nature of an improvement; but when the added element is essential to the production of any useful result such an addition is not an improvement, but its use gives birth to the only patentable (because the first useful) combination. Notwithstanding, then, the conceded fact that the combination which includes the lug, with other elements, which are described in the reissue of 1869, is useful, it is nevertheless necessary, in order to sustain the reissue, that it should appear that the device there described, which does not contain the lug, is of some utility. As before stated, the contrary here appears, and for this reason the patent must be declared invalid.

[*George Gifford*, for complainant.
B. E. Valentine, for defendant.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 14 to March 5, 1873, inclusive.

BOARDING LEATHER, ETC.—W. J. Coogan, Pittsfield, Mass.
CAR VENTILATOR.—R. Hitchcock, Springfield, Mass.
FINISHING BOOT SOLES, ETC.—L. R. Mears, New York city.
FUR-COATED FABRIC.—H. Kellogg, Milford, Conn.
GAS, ETC.—J. C. Tiffany, Portsmouth, N. H.
GRAINING, ETC.—J. J. Callow, Cleveland, Ohio.
HAND STAMP.—D. W. Fish, Brooklyn, N. Y.
HOSE PIPE.—G. McKay, Boston, Mass.
LAMP.—T. H. White, E. Knight, Cleveland, Ohio.
LASTING BOOTS, ETC.—J. W. Brooks, Boston, Mass.
MAKING HATS, ETC.—A. Bogardus, Matteawan, N. Y.
MAKING NUT BLANKS.—J. Ostrander, Richmond, Va.
MULTIPLE CRANK DRILL, ETC.—C. F. Ritchell, New York city.
ORNAMENTING PAPER, ETC.—F. Beck, New York city.
PAPER PULP ENGINE.—S. L. Gould, Skowhegan, Me.
PENCIL HOLDER, ETC.—W. H. W. Campbell, Norwich, Conn.
RAILROAD CAR SPRING.—H. Gardiner, New York city.
TRIMMING BOOT SOLES, ETC.—S. H. Hodges, Lynn, Mass.

Recent American and Foreign Patents.

Improved Cultivator.

Singleton L. Young, Scottville, Ill.—The invention consists in the improvement of cultivators. To the upper side of the ends of the axle tree are pivoted axle arms upon the journals of which revolve the wheels. The latter are made with a flange upon the center of their rims to prevent them from slipping laterally upon the ground, and to cause them to operate more promptly in guiding the plow. The inner ends of the axle arms are made wide and have transverse slots formed in them curved upon the arcs of circles, having their centers at the pivoting points of said arms. The edges of the wide inner ends of the axle arms are curved upon arcs concentric with the slots in said ends, and have teeth formed in them, which mesh into the teeth of the gear wheel pivoted to the center of the axle tree, so that, by turning the said wheel in one or the other direction, the direction of the wheels and consequently of the machine will be changed. To the gear wheel is rigidly attached a rearwardly projecting handle, by means of which the plowman can readily turn the said wheel to guide the machine. The plow beams are placed end to end, and each is connected with the axle tree by two draft rods, the forward ends of which are pivoted to the axle tree, and their rear ends are pivoted to the forward side of the beams near their lower edge. Braces are pivoted to the forward side of their beams near their upper edge. The forward ends of the braces are secured to the sides of the draft bars, several holes being formed in the said end of the braces to receive the fastening pin or bolt, so that, by adjusting the relative length of the draft rod and braces, the inclination or pitch of the plows may be adjusted at will.

Improved Fertilizer.

John W. Stubbs, Cheraw, S. C.—This invention has for its object to furnish an improved machine for distributing guano or other fine fertilizer. To the off-side of a beam, similar to a plow beam, is attached a standard, to the lower end of which is attached a plow, for opening a furrow to receive the guano. To the near side of the rear end of the beam is attached a standard, to the lower end of which is attached a plow for filling up the trench or furrow to cover the guano. To the standards and to the beam between said standards is attached a board extending nearly to the ground, to which and to the beam is attached a hopper to receive the guano to be distributed. From the bottom of the hopper the guano passes through an opening in the vertical plate into the distributing hopper, which is made in the form of the frustum of the cone, and its smaller and closed end is securely attached to a wheel, which is rigidly attached to the shaft. The side of the plate against which the mouth of the distributing hopper bears may be covered with a metallic plate to prevent wear. The mouth of the distributing hopper is supported and secured in position by radial arms attached to the shaft. To the shaft and inner part of the arms is attached a small metallic plate for the forward end of a screw to rest against to hold the mouth of the hopper at a greater or less distance from the plate, according as it is desired to distribute more or less guano.

Improved Photographic Negative.

Joseph Kirk, Newark, N. J.—This invention consists in coating a glass plate on both sides, or coating two plates and putting one at the back of the other, with collodion or any other compound used in producing negatives for photographic purposes, whereby, when the plate or plates are exposed to the subject to be photographed and developed in the usual way, a faint image is produced on the back of the plate or on the second plate in addition to the image on the front. This has the effect of blending the highest points of light gradually with the shadows of the printed photograph, giving a beautiful, soft, and porcelain-like effect, and saving a great amount of labor in retouching negatives for portraiture.

Improved Steering Apparatus.

John F. Sparr, Rochester, N. Y.—This invention consists in combining a propeller shaft and screw with a balanced rudder, and in certain operative mechanism. The invention consists, principally, in carrying the shaft which propels the screw through the tubular upper spindle or pivot of the rudder, and in hanging the propeller in the rudder. The propeller can thus be freely revolved without affecting or interfering with the motions of the rudder, and the rudder can be freely turned without interfering with the rotation of the screw; but the screw will follow the oscillations of the rudder, and apply its power in the desired direction to the vessel, thus aiding in the process of steering. Vessels provided with this apparatus can be turned on sharp curves and rapidly with safety. The invention is designed to be applicable to canal steamers and to men of war, and also to all other steamships.

Improved Propelling Mechanism for Vessels.

John Welch, New York city.—This invention is an improvement in the class of vibrating propellers provided with floats or paddles pivoted so as to swing in either direction according as the boat or vessel to which the propeller may be applied is to move forward or back. The improvement consists in the provision of bent rods, in combination with floats pivoted horizontally and at their upper edges, whereby the movement of said floats is controlled. By suitable arrangement, when the boat is to move forward, a forward crank is turned parallel with, and another at right angles to, the paddle frame, so that the said paddles, when moving forward, may take a horizontal position to pass through the water with the least possible resistance, and when moving to the rearward will be in a vertical position to bear strongly against the water. When the boat is to move backward, the positions of the rods will be exactly reversed.

Improved Machine for Cutting Stone.

Christopher E. Odgers, Bloomfield, N. J.—This invention consists in improving stone cutting machines. To the top of the frame of the machine, near one end, is pivoted a shaft to which are attached radial arms, upon the outer ends of which are formed cams to operate the hammers, said arms being so arranged that each hammer may be operated four times at each revolution of the shaft, and that no two adjacent hammers may be operated at exactly the same time. The hammers are pivoted to a shaft connected with the upper part of the frame, and their rear ends are slotted and have a friction roller pivoted at the outer end of said slot for the cam arms to operate upon. The faces of the heads of the hammers are concaved, so that they may strike fairly upon the ends of the chisels, however said cutters may be adjusted. The journals of the cutter holder are secured to the frame, so that the holder may be conveniently adjusted to hold the cutter at any desired inclination, and, when adjusted, may be held securely in place. The cutters are made with a shoulder upon their upper and upon their lower side, and are placed in slots in the holder, which recesses are made with a shoulder to receive the lower shoulder of the chisels, to prevent the possibility of the chisels descending too far. The cutters are raised to receive the blow of the hammers by springs attached to the holder, and which bear against the upper shoulders of the cutters. By this construction the work will be done in a manner very similar to hand work. To the base of the frame is secured a track, along which roll the wheels pivoted to the ends of the side bars of the carriage frame. The stone to be operated upon is secured in place upon the platform of the carriage by pointed screws which pass through nuts attached to hook plates, so that the holding device may be readily adjusted to different sized and different shaped stones. Suitable mechanism is provided so that the stone may be drawn forward beneath the cutters automatically.

Improved Wagon Body and Seat.

Peter S. Rich, Avalanche, Wis.—This invention relates to wagon bodies and wagon seats designed for light pleasure wagons, either open or covered The sides of the body are bent so as to form round corners, and are connected together at front and rear by straight pieces, the joints being securely nailed. The sills are joined together at the corners and supported by angle irons. The dashboard is supported by a bow, the ends of which are confined to the sill by angle irons. This bow is made of wood, and the dash board is attached to it. Wood ovals are connected with the upright sides of the bow and attached to the outer ends of the dash board. The seat is formed of bent sides and straight back connected together with nails, and with arm pieces extending from the back piece to the front of the seat, and supported by the stay irons which extend down on to the bottom of the seat. These arms, where they are connected with the back piece, are secured with plates of metal. It will be seen that there is no working against the grain of the wood in constructing a body and seat of a wagon in this manner, and that the full length of the timber is preserved throughout. The body and seat are consequently more durable than those made in the ordinary manner.

Improved Self Closing Hatch.

Charles H. Reynolds, Williamsburgh, N. Y., assignor to himself and Henry C. Richardson, of same place. This invention has for its object to furnish an improved device for holding the hatches of a hoistway or elevator well raised or open, and which shall be so constructed that in case of accidental fire the hatches will be closed automatically. As the hatches are raised or opened, arms attached to them strike latches, raise them, and slide along their lower edges till they enter the notches in said latches, and the hatches are thus held raised or open. The latches are so arranged with respect to the hatches that when the said latches are raised the said hatches will drop shut by their own weight. A pipe or tube passes up through the various floors of the building, except the lowest one, and through the roof. The ends of the tube are left open, and openings are formed in its side above each floor. A rope, which passes down through the tube and its upper end, is secured in the upper end of the tube. The lower end of a rope is attached to a lever. One end of the lever is pivoted to a support attached to the lowest floor, and to its other or free end is attached a weight. Upon the pivoted end of the lever is formed an upwardly projecting arm upon the end of which, when the weighted end of the lever is raised, rests the lower end of a rod, which passes up through all the floors and to which is pivoted the inner ends of the latches. By this construction, when the weighted end of the lever drops, the arm is withdrawn from beneath the lower end of the rod, allowing said rod to drop. The downward movement of the rod raises the outer ends of the latches, which recloses the hatches and allows them to drop shut. Should a fire occur near the hatchway, the tube will act as a flue to draw the flames into it so that the rope will be quickly burned off, allowing the weighted lever to drop, and thus closing the hatches. If desired, the rope may be coated with some substance that will ignite readily, so that the rope will burn off quickly and close the hatches.

Improved Seed Dropper.

Frank W. Young, Holden, Mo.—This invention has for its object to furnish an improved seed dropper for corn planters, so constructed that the size of the dropping apertures may be conveniently adjusted to any desired extent, according to the amount of seed required to be dropped at a time. Two boards form the bottom of a seed hopper, between which is placed a wheel, which is pivoted at its center to the lower board. In the upper board is formed a round hole, of such a size that the edge of said board may slightly overlap the upper edge of the wheel, so that the seed may rest upon the board and wheel but cannot get into the space between the boards. Through the wheel, near its outer edge, is formed a circle of holes, the outer parts of which are semicircular. The upper ends of the holes are open, so as to receive seed from the hopper, and their lower ends are closed by the lower board, so that the seed cannot escape from the said holes until each hole comes over a hole in the board through which it escapes to the ground. The middle part of the upper side of the wheel is recessed to receive arms pivoted to the under side of a disk, so that they may be drawn inward or pushed outward by turning the disk in one or the other direction. The dropping apertures may be enlarged or diminished by the inward and outward movement of these arms. The disk is clamped to the wheel. The wheel, at each movement of an actuating bar, is turned a distance equal to the space between two adjacent holes.

Improved Pulp Strainer.

Henry H. Olds, New Haven, Conn.—The object in this invention is to provide means for separating the pulp of apples, pumpkins, and similar articles from the cores, seeds, and skins; and it consists in a machine having a semi-cylindrical strainer provided with a rotary central shaft and cylinder with elastic wings or webs placed spirally thereon for crushing and forcing the article to be strained. The articles are boiled or steamed so as to be soft and readily crushed, and are fed into the machine through the hopper, where they come in contact with the revolving wings, which crush the pieces and force the pulp through the strainer. The cores, seeds, skins, etc., will be carried along to the other end of the strainer, and may be discharged from time to time, as may be necessary. The wings, by reason of their elasticity, will rub against the strainer and crush the fruit and force the pulp through it.

Improved Hand Corn Sheller.

James M. Hawley, Alma, Ill.—This invention consists in an improved hand corn sheller. Two disks are connected to each other and held in their proper relative positions by a band securely attached to their edges. A part of the band is cut away to form an opening, through which the shelled corn may be allowed to escape. Two parallel bars are arranged, upon the outer side of each of which is formed a hollow journal, which journals pass through holes in the centers of the disks. The bars at one end are kept at the proper distance apart by a block, to which they are attached. To and between the other ends of the bars are pivoted the outer ends of two arms, upon the inner ends of which are formed semicircular jaws. Upon the upper edge of each of the jaws are formed three teeth, the two rear ones of which upon each jaw are made smaller than the others, and are arranged upon the arc of a smaller circle so as to operate upon and remove the kernels from the point or small end of the ear. The front tooth upon each jaw is made longer and projects forward in hook form, so as to move along the cob and force the kernels off laterally and toward the shelled end of the cob, so that they may be removed with less force. The upper and lower edges of the arms are cut away so as to leave narrow bearings to rest against the inner surfaces of the bars. The arms are kept from getting out of position by a stop. The bars are held toward each other, pressing the jaws against the ear by coiled wire springs, so that the said springs may press against the outer sides of the said arms. A hollow journal is made of such a size that the unshelled ear may readily pass through it. Another hollow journal may be made smaller, as only the cob has to pass through it. To the projecting end of the second hollow journal is attached a bevel gear wheel, the teeth of which mesh into the teeth of another bevel gear wheel attached to the end of a shaft which revolves in bearings attached to the brackets, by which the machine is supported and secured to the table. To the outer end of the shaft is attached the crank by which the sheller is operated.

Improved Pruning Shears.

Thomas Borden, Squancum, N. J., assignor to himself, David P. Kisner and Thomas Hulett, of same place.—The object of this invention is to provide a convenient and improved shears for pruning shrubbery, designed more especially for pruning or cutting hedges, but applicable to other purposes. The invention consists in a new mode of making four blades work together so as to form three pairs of cutters. The two central blades work together the same as the cutting blades of ordinary shears, but these blades have two edges each. The outer edges work in connection with the branch blades In one of the levers near the fulcrum pin is a recess, and through the other lever a lug rivet, which rivet projects so as to enter the recess and form a stop to limit the action of the levers. By this construction three pairs of cutting edges are formed, and the operator has really three pairs of shears for one pair of handles; but the shears may be made with but one branch blade, and consequently there would be but two pairs of cutting edges.

Improved Vibrating Propellers.

Charles P. Macowitzky, Corpus Christi, Texas.—This invention has for its object to furnish an improved device for propelling steamers, enabling the movements of the vessel to be controlled readily and so effectually that she may be turned almost upon her axis. The device is designed to be placed upon the bottom or sides of the vessel below the surface of the water, and one or more upon each side of the keel. The inner end of the piston rod is screwed into an arm, which passes through a slot in the bottom or side of the vessel, and its outer end is connected, in the manner hereinafter described, with a block or plate which slides in a short slot in the frame. To the outer side of the block or plate is securely attached a rack bar which slides upon the outer surface of the frame, and into its teeth mesh the teeth of small pinion wheels rigidly attached to the paddles. The paddles are securely pivoted to the frame. Two stops are attached securely to the piston rod arm, and strike alternately against other stops, placed between them and secured to the frame to limit the movement of the plate. A screw is swiveled to two lugs. By turning a screw the piston rod arm, and with it the stops, may be adjusted to reverse the paddles. As the screw is turned in the arm the piston rod must also be turned in the said arm to keep the arm in proper position, so as not to interfere with the stroke of the piston. This is done by connecting the screw and piston rod with each other by equal sized and equal toothed gear wheels. The piston rod or screw may be turned from the pilot house by a screw and screw wheel or other suitable gearing. In operation, as the piston rod moves in the proper direction to drive the vessel forward, the first effect is to slide the arm and plate upon the frame, moving the rack bar and projecting the paddles to bear against the water. As the stops strike, the arm plate frame and paddles are all carried along together, the paddles acting upon the water to propel the vessel. As the piston rod begins its return movement the first effect is to move the arm and plate upon the frame. This moves the rack and turns the paddles in a horizontal position, so as to pass through the water with the least resistance. The arm plate, frame and paddles then move on together.

Improved Barrel Support.

Frederick W. Claussen, Mars Bluff, S. C.—The object of this invention is to provide a device by which barrels may easily be tipped over into an inclined position, so that not only the bottom parts of the same are easily reached but also space economized, as the barrels may be placed out of the way under the counters, shelves, or other fixtures. The invention consists of an upright piece of wood pivoted horizontally to transverse ears, and carrying under right angles a strong cross piece, supplied at one end with a vertical support to rest upon when placed in horizontal position. The pieces are so fitted that the bottom of a barrel may be placed on them and follow the motion of the same.

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Improved Sink Trap.

Nicholas Wright, New York city.—This invention is an improved sink trap so constructed as to prevent the possibility of the waters being siphoned out, or the offensive gases from the waste pipe escaping through the trap into the room; which shall, at the same time, be easily opened and cleaned when required. By suitable construction, as the water flows through the inlet pipe into the trap, a float rises, raising a valve so that the water can flow out through the outlet pipe. As the water in the trap lowers; the float descends and closes the valve before the water has fallen sufficiently in the trap to uncover the lower end of the inlet pipe, so that it may be impossible for any offensive gas to escape through the trap into the room.

Improved Lock.

Elizabeth Duenz and John A. Duenz, Fayetteville, Ill., administrators of Casper Bodmer, deceased.—This invention relates to door locks having tumblers and dumb levers, and consists in a false bottom having certain slats and notches; in a tumbler having a stop and pivoted to the sliding bar; in a ward having an arm that operates against a pin to swing the sliding bar and tumbler clear of obstructions; in a pivoted tumbler combined with a sliding bar pivoted to a bolt; in a tumbler pivoted to a sliding bar and having a projection working in a notch of the false bottom; in a movable tumbler and stationary plate arranged in the same plane; and, finally, in a vibrating plate that acts at once upon a pin and bolt.

Box for Assorting Peaches.

Edward W. Lockwood, Middletown, Del.—The invention consists in a box constructed so as to separate the leaves from the peaches, and allow them to be hand picked as they are poured into the peach baskets. It consists of two sides and an open slat bottom supported by two frames at a convenient hight from the ground. The box is placed so that the bottom is inclined longitudinally, and so that the peaches will have a tendency to roll from the upper to the lower end. The bottom is made of rounded slats placed at about one inch, more or less, from each other. The peaches, consisting of good and bad together, with more or less leaves, are gathered in baskets and emptied into the upper end of the box. A person stands by the side of the box and picks out the defective peaches as they roll down the bottom, while the leaves pass through the bottom between the slats. The marketable peaches are caught in a basket at the lower end.

Machine for Corrugating Sheet Iron.

Abram Reese and Jacob Reese, Pittsburgh, Pa.—This invention consists in the novel construction and arrangement of a series of corrugating rollers, whereby a sheet of iron is corrugated by passing it once through the machine without cracking or fracturing the iron, and is thus prepared for roofing and siding buildings, and for all similar purposes. The first pair of rollers makes a single corrugation in the middle of the sheet. The next pair of rollers makes two corrugations, one on each side of the first corrugation; and the third pair of rollers makes two more corrugations, one on each side of those already made. The fourth pair of rollers is constructed and arranged to receive all the corrugations made by the three previous pairs, and they correct imperfections and straighten the sheet. The rollers of each pair are geared together at one end; and, at the other end, the pairs of rollers are geared together so as to give all the rollers the proper speed, that they may revolve in unison with each other.

Improved Saw Gummer.

Henry Baughman, Dorn's Gold Mines, S. C.—This invention has for its object to furnish an improved machine for gumming saws; and it consists in a vertical frame, secured to its support by a bolt, and another frame suspended to it by suitable means. The emery wheel is attached to the end of the shaft, which revolves in bearings attached to the front bar of the suspended frame, and its rear end revolves upon the point of a center screw. To the shaft is attached a grooved pulley, around which passes the band by which the emery wheel is driven. A holder for the saws is bolted to the base bar of the upper frame. The saw plate is placed at the side of the holder with its rear edge resting upon the shoulders of small flanged eccentric wheels pivoted to the lower part of the side of the said holder, and which are provided with handles for convenience in adjusting them according to the breadth of the saw plate. The pivoted frame is operated by means of a handle or handles formed upon the projecting ends of a side bar. An adjustable guide is provided to limit the movement of the frame, and thus insure the uniformity of the teeth.

Improved Extension Table.

August Herzog, New York city.—This invention relates to a new extension table, whose middle portion is vertically adjustable and made self-elevating, so that when the sliding extension leaves, which are above it while the table is contracted, are drawn apart, such middle portion will spring up and fill the gap between the sliding leaves, thus producing a perfect extended table, and also an unobjectionable form of contracted table.

Improved Car Coupling.

John W. Gillam and John W. Gillam, Jr., Newton, N. J.—This invention relates to a new form of car coupling in which a drawhead is made with opening large enough to insure the entrance of the connecting bar. A square space is formed in the sides of the drawhead, of sufficient width and depth to admit the cross bar, which is firmly held therein by a spring fastened at the back of the drawhead. The connecting bar is a flat piece of metal, with a catch at each end and a narrow rib running across the center from catch to catch, corresponding in hight with the catch, the object of the narrow strip being to prevent the connecting bar from engaging with the rim of the drawhead after being disengaged from the cross bar. The cross bar is recessed out in the center to enable it to properly engage with the connecting bar. An upright piece is fastened to the drawhead, by means of which the catch of the connecting bar is prevented from passing too far back of the cross bar. The lifting bar is fastened to the platform, one end being attached to the cross bar, the other end being under and acted upon by the lever. The lever is attached to the end of the platform, and is so arranged that, when moved from left to right, it forces that end of the lifting bar down and raises the cross bar end up, thus disengaging the cross bar from the connecting bar. When the lever is thrown back to the left the spring forces the cross bar back to position, ready to engage with the connecting bar when the cars come together.

Improved King Bolt for Carriages.

John L. H. Mosier, New York city, assignor to Brewster & Company, of same place.—This invention has for its object to improve the construction of king bolts for platform carriages so as to give a smooth finish to the top plate of the front bed of the top carriage. The invention consists in the cross head formed upon the king bolt, and the corresponding recess formed in the top plate of the front bed of the top carriage, said crosshead and recess being so formed as to correspond and leave the upper surface of the crosshead flush with the upper surface of the said top plate, giving a smooth finish.

Novel Chair Seat.

William T. Doremus, New York city.—This invention has for its object to furnish improved seats for chairs and other articles of house and office furniture, which shall be strong, durable, very elastic, simple in construction and inexpensive in construction, enabling the manufacturer to work up the waste pieces of lumber derived from other articles of furniture. The improvement consists in an ingenious division of the seat and the placing thereunder, below each division, of compact springs, upon which the seat divisions rest with considerable leverage, the whole forming a substantial, elastic, and superior seat. The invention may be applied in various forms, and is likely to have an extensive introduction.

Improved Seed Planter.

Reuben Friday, Crockett, Texas.—The invention consists in an improvement of seed planters. The plow is adjustably secured to the draw bar so that it may be conveniently raised and lowered. To the draw bar, directly in the rear of the opening plow, is attached an adjustable bar, the lower end of which is made V-shaped so as to press upon the furrow to receive the seed. To a shaft, which revolves in bearings on the frame near its ends, are attached two circular disks, in the outer part of the inner sides of which are formed zigzag grooves to receive the ends of the plates that form the body of the dropping cylinder, and thus make said body star-shaped in its cross section. The outer edges of each pair of plates meet at the circumferences of the disks, and are secured in the latter by metallic bands. One of the plates is made detachable, a notch being formed in the bands so that it may be slipped out to form an opening for the convenient insertion of the seed. In the center of the salient angles of the dropping cylinder are formed holes of such a size as to allow the proper amount of seed for a hill to pass out, the edges of the plates at the holes being notched to allow a cleaner to clean out any soil that might enter said holes and clog them. Two curved spring bars are adjustably attached to the frame, and to their rear ends are attached the ends of the covering bar, which is held down upon the surface of the ground with sufficient force to cover the seed. The middle part of the under side of the said coverer is concaved, to give the proper form to the top of the ridge or row.

Improved Safety Valve.

Henry Davies, Newport, Ky.—This invention has for its object to furnish a device for automatically regulating the pressure of steam, gases, fluids, etc., without regard to the pressure in the boiler, generator, or reservoir, or to the amount passing through the machine. A polygonal dish-shaped recess is formed in the upper part of the body of the device. A double beat valve closes and opens the ports leading from the valve chamber at the opposite ends of the valve. A diaphragm of sheet metal rests upon the edge of the dish and is secured. Radial or triangular plates rest upon the diaphragm, and their base ends or sides enter a rabbet in the lower inner edge of the securing ring. The small ends or apexes of the radial plates reach nearly to the center of the dish, where they are secured in place by the collar upon the collar pin, the lower end of which rests upon the center of the diaphragm. The outer ends of the plates are rounded off, and their inner ends are rounded off and grooved to enable them to move easily with the movement of the diaphragm. The pin is held down by a lever and weight and passes up between two brackets formed upon the ring. The pivot of the lever is a knife edge, and the upper end of the pin is conical or pointed, so that the lever may work upon its bearings with the least possible friction. The valve is made in two parts, connected together by a stem to which they are secured. The upper end or head of the stem passes through a guide in the valve seat, which is made in the form of a bushing to allow the upper part of the valve to be inserted. The upper end of the bolt or stem abuts against the center of the diaphragm directly beneath the lower end of the collar pin. The other or lower end of the stem, below the nut, is made smaller, and extends into and works in a guide hole in the cap that closes the opening through which the lever part of the valve is introduced. In using the device, the weight is adjusted into such a position upon the lever that it will require exactly the required amount of pressure upon the diaphragm to raise it. The upper part of the valve is made the larger, so that, were the valve left free and steam introduced, the valve would be closed by the steam pressure. The valve is pressed down and opened by the pressure of the weight pressing the diaphragm down upon the upper end of the stem. As long as the steam pressure on the dish is equal to or less than the amount determined upon, the valve will remain open and the steam will flow continuously. Should the pressure in the dish at any time exceed the amount determined upon, it will raise the diaphragm, allowing the steam pressure to close the valve until the pressure in the dish has been again reduced to the desired amount, so that the pressure in the dish, and consequently in the passage, will be kept always the same, whatever may be the pressure in the boiler.

Improved Journal Box.

Samuel Aland, Rome, N. Y.—The first part of the invention consists of a tubular box with a ball at the center for being confined in a socket; also, for having a chamber for containing oil to lubricate the journal, with passages for the oil to the journal box cast in one piece, whereby it is more durable than those composed of a tube fitted in a large hole in the shell of the box, and it can be made cheaper. The second part of the invention consists of a socket in the end of the box with a discharge passage from the bottom adapted to receive the drip escaping from the end of the box and conducting it to a receptacle, and a groove in the face of the shaft behind the shoulder of the journal, which prevents the drip from escaping along the shaft.

Improved Hand Stamp.

George H. Rountree, Milwaukee, Wis.—This invention consists of a hand stamp in which the stamp head is pivoted between two bars at one end, which at the other are pivoted to the base plate between the stamp pad and the inking pad, so that, as the stamp is raised up from one pad, it swings over to the other, and *vice versa*. One of the said bars has a pawl, which turns the inking pad to present fresh surface to the type at each operation. The object is to avoid the use of the expensive inking ribbons employed in the stamps now commonly used. It is a very simple and effective stamp, cheaply made, and neat in appearance.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN *Patents.* This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

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Persons desiring any patent issued from 1836 to November 25, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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Notes & Queries

O. P. S. wants to know the best process for tempering locomotive springs.

A. McG. asks how to find the bevel on the backs of the posts of an octagonal church spire.

F. A. S. asks: How can a small round hole be made through a pane of glass without the use of a diamond?

S. H. S. asks for the best and cheapest way to manufacture lime from the common limestone, and how it can be done on an extensive scale.

W. H. F. would like to enquire how to redye with cochineal. "I have some flannels dyed in this stuff, and by accident it has nearly all been taken out."

J. F. G. asks: 1. How can I bleach Mediterranean rice shells that have burned yellow or a dull color. 2. How can I plate iron wire with nickel without the use of a battery, and what is the solution?

H. N. S. asks: What is the best substance known for coating iron patterns so as to cast on a chill and obtain the best surface in hard brass or composition? We have used black lead and oil, but not with very good results.

H. H. asks: In boiling sugar to say 300° Fah., is it economical in point of fuel and time to use air tight vessels, pumping off the vapor as soon as formed? At what temperature will steam readily boil liquids to 400° Fah.?

R. P. asks: 1st. What is the best preparation of paint, for engines or other hot surfaces, that will not scale off? 2d. What is the best kind of varnish to use on an engine cylinder, enclosed in what is called a wooden jacket? 3d. What is the best mode of preparing an iron cement for joints of safety valves?

J. M. asks for a rule to calculate the proportion of suction and discharge pipes to pumps (for different sizes of cylinders.) "I have 3 or 4 five inch cylinder pumps, 15 inches stroke, under my charge, and I would like some one to give a rule to find the size of both pipes."

A. W. P. asks: Is there any process whereby an oilstone can be softened? I have in the last few years bought four or five of the most celebrated oilstones in this country, but I have been rather unfortunate in selecting. After a little use they all proved to be too hard, and rubbing a tool on them is like rubbing on glass.

J. H. W. says: Is there a probability of giving a fan mill too much speed? If so, what speed should I give a fan 30 inches long and 20 inches in diameter, so as to make it send the proper draft of air? The draft is required to be very strong. What diameter is preferable for a fan to blow a strong draft of air?

E. L. asks: What is the mode of operation of a hydraulic apparatus seen sometimes in store windows, etc., as a curiosity? It consists of a glass tube bent in elliptical form put into a grotto or fountain, with its major axis towards the zenith, and different colored fluids ascending and descending with regularity. How are the fluids put in motion, and how are the different colors kept separate in ascending and descending?

W. U. says: We have some trouble with a boiler which foams. We dug a well and got water in plenty, but when we used it the froth would discharge through the safety valve with but 60 lbs. of steam. We then built a pond in a running brook some distance off, and brought the water through pipes which gave immediate relief; but the pipes got clogged so there was no passage. We again tried the well water, but it seemed to foam worse than ever. I would like to know the cause and the best preventive.

Answers to Correspondents

V. P. sends a mineral and asks what it is. Answer: Iron pyrites; it is of no special value.

A. A. F. says, in reference to the extinction of fires by steam, that he has known an instance of it by opening the safety valve of a boiler. This filled the building with steam and saved it from destruction.

C. H. encloses specimen of ore, of which he would like to have name and value. Answer: The specimen is too small to allow reliable tests, but it appears to be tourmaline.

E. B. G. says: Enclosed please find two specimens. What are they and of what value? Answer: The white stone is a fine grained sandstone containing some clay, and might be useful as a "fire stone." The other is zinc blende.

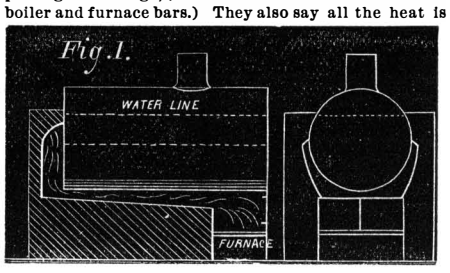
A. C. R. sends a mineral specimen and asks what it is, and if it could be polished so as to counterfeit diamond. What is the value of it? Answer: It is limpid quartz, and would not make so good a counterfeit as French paste.

A. R. G. sends a stone, found in a vein of coal, and asks what it is. Answer: It is a pebble of quartz.

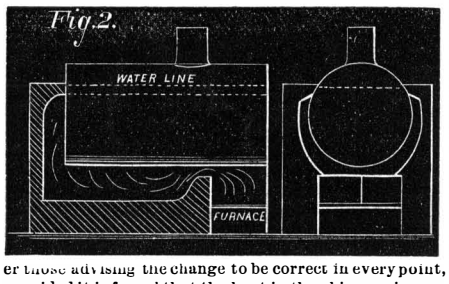
A. B. sends three specimens and asks what they are. Answer: The specimens are blue clay, graphite and brown hematite.

O. says: What will be the probable cost of a visit to the Vienna Exposition by a not wealthy young man, starting from and returning to New York, stopping in England to look at some of their shops? Please give the best route. Answer: A good route to Vienna is *via* Glasgow, Edinburgh, Manchester, Birmingham, London, Paris, Lyons, Turin, Venice, Trieste, Vienna, and back *via* Munich, Frankfort, Brussels, Rotterdam and Hamburg or Bremen. Take a map and select a route that meets the special case. There are dozens of routes, direct and indirect. As to cost, see answer to another correspondent. Go with an old traveller, if possible, and especially if not able to speak French and German fluently.

A. S. says: I send you sketches, Fig. 1, of our boilers as they now stand, and Fig. 2, as some practical builders and engineers say they ought to stand. They say the bricks are built too close to boiler after passing the bridge, (the furnace is 18 inches between boiler and furnace bars.) They also say all the heat is



in the chimney and none round the boilers. According to their recommendations, Fig. 2, (1) there ought to be a pit after passing the bridge, to allow a certain kind of gas to get down until mixed with air, then it will burn; likewise to allow a person to get under to examine the bottom of boiler. 2. The furnace should be at least 27 inches deep between bottom of boiler and bars, to allow a larger fire, to get more heat out of the same fuel. 3. The brick wall ought to be 32 inches at least, to confine the heat to the boilers. 4. The space up the sides of the boiler ought to be open nearly to water line. They say, by the above alterations, we shall have more heat and more steam, with less fuel. Answer We should consid-



er those advising the change to be correct in every point, provided it is found that the heat in the chimney is now excessive, and that the gases are not thoroughly burned. Suspend cuttings of good tin, lead and zinc separately in the middle of the chimney. If the tin remains unmelted the temperature is low enough for good draft; if the lead melts, it may be still within fair limits; if the zinc melts, it is certainly considerably too high, and money is expended in the chimney. A large combustion chamber behind the bridge wall is usually found of great value in securing perfect combustion of any carbonic oxide and smoke that might otherwise be wasted.

D. A. M. asks: What is the horse power of a cylinder boiler 24 feet long and 30 inches in diameter, and what is the rule by which you compute the same? Answer: The power of such a boiler is generally estimated at about 20 horse. The rule in use among old engineers allows a horse power for each cubic foot of water evaporated per hour, but builders are now oftener allowing but one half that quantity, as a good engine should not use more than 30 pounds of steam per horse power per hour. With well proportioned tubular boilers the total heating surface divided by 12 will give the horse power, very nearly, on the latter basis. With cylinder boilers, the heating surface is much less in area and is nearer the fire. Their performance may usually be estimated by dividing the pounds coal burned per hour by four or four and a half, for long and for short boilers erspectively.

C. F. E. says: An artesian well in our neighborhood was recently put down in the following manner: A 6 inch pipe is driven down for 84 feet, or until it strikes bed rock, then a hole is drilled of the same diameter 234 feet through the rock, making a total depth of 318 feet. Here we stop in shale, with the well flowing at the rate of 11 gallons per minute, which has not increased or diminished for about two weeks, or since we stopped drilling. This well is intended to supply the steam fire engines. The engines have a capacity of 600 gallons per minute, but the well will not supply over one tenth the amount required. A neighbor says: "If you drill a hole through the top of the hydrant and then let down a tube 35 feet long, say two inches in diameter, and carefully solder it at the top so as to admit of no air passing between the joint formed by the tube and hydrant, you are enabled to raise the water to a depth of upwards of thirty feet; and as I have good reasons for believing that the well will maintain its hight at not exceeding fifteen feet from the surface, you will thus be supplied with an inexhaustible supply of water, and it will not cost to exceed ten or fifteen dollars." What I wish to know is, shall I be able to raise any more water with the pipe in as he proposes, or less? My own opinion is that air would get in. The water contains considerable salt, a little more than sea water. Is it fit to use in a boiler? The engine contains about the usual number of tubes. Answer: Our correspondent has very sensible views of the case; the writer of the slip which he encloses cannot be as highly complimented, we think. Such salt water, if used in steam engine boilers, with even careful and frequent blowing out, would be apt to destroy them.

F. R. M. says: A party claims to have made a discovery in tempering steel implements, and some millers, for whom he has sharpened and tempered picks, claim that one pick thus tempered is equal to 20 ordinarily tempered, and that, notwithstanding they are hard enough to cut glass, they do not break, but are hard and strong. I want to know what chemicals enter into steel to give it these qualities? How do manufacturers of edge tools temper them, and cutlery, etc.? I want a process of tempering steel that can be utilized in dressing mill picks, mining drills, picks, etc. Answer: We have little faith in quack medicines for steel. Look through these columns in back numbers of the SCIENTIFIC AMERICAN and select the most promising of the many recipes there published.

S. F. P. says: At what point in a perpendicular tube 38 inches in diameter and 20 feet in hight, fully supplied with water, should a turbine wheel be placed to be most efficient in driving machinery? There is a turbine wheel in this vicinity set at about the middle of such a tube, but it does not seem to give the power that the stream ought to furnish. Would there be a gain in placing it as near the bottom of the tube as practicable, and if so, what percentage? Answer; With the lower end properly sealed against the entrance of air, a wheel of the Jonval class should give equally good effect at any point of the tube. With any such wheel, there could not be expected a gain by change of position. Test the wheel with a dynamometer, or get some competent engineer to do it, and thus determine precisely the value of the wheel. If the effect is not what it should be, throw it back upon the hands of the builder, if he cannot make it efficient.

M. says: I have a small steam boiler 12 inches diameter x 30 inches long. It is horizontal, with no flues. The plates are ¼ inch thick. How many pounds steam can it stand to the square inch? What diameter of cylinder, and what length of stroke should I make to suit the size of the boiler, to run 100 revolutions per minute, and what amount of horse power would it be? Answer: If new and well made, such a boiler would either blow out the heads at some very high pressure which can best be determined by cold water pressure, or give way in the longitudinal seams at about 1,100 pounds. We should be inclined to load its safety valve to 200 pounds, and to put a stay rod through the middle of the heads to prevent their springing under pressure. It is too small to estimate power with accuracy. Perhaps a two inch cylinder, 6 inches stroke, may give, with a good fire under it, a half or three quarter horse power. Such toy boilers are not economical in fuel.

J. P. R. H. asks: I. Can water be confined in a boiler until it attains a red heat, or nearly so, without danger? What will be the pressure per square inch? 2. I have read in the SCIENTIFIC that water deprived of air will explode or all evaporate suddenly; is not that the cause of explosions, or is it untrue? 5. I would also like to know if I can make a grout or gravel wall out of sand or fine gravel, suitable for a foundation, as stone and brick are scarce and costly. What process is best? 4. What is used as a bath for tempering steel for tools and how is the steel worked before tempering? Answers: 1. The pressure of water confined at a red heat would be too great to be controlled by known materials. We cannot tell how much it would be. 2. Such an action may have caused some explosions, but we have shown in an earlier number of the SCIENTIFIC AMERICAN that it is improbable that it is a frequent cause. Look through our back numbers. 3. By working it as dry as possible and properly ramming it, grout can be made an excellent foundation, not only for an ordinary wall, but for as heavy a structure as a blast furnace. 4. Recipes and methods for tempering tools may be found described and discussed in nearly every number of this paper.

J. G. S. says: I would like to know of something, other than water, to stop the formation of electricity in leather rubbers on machine cards. 2. Are compasses which describe a circle with a pencil, instead of scratching, patentable; one arm being like ordinary compasses, and the other having a sleeve on it to hold a common carpenter's pencil, and a thumb screw to hold it tight? Answers: 1. We know of no practical device for the purpose. 2. The device is very old, and is in daily use in every drafting room.

A. H. C. asks: 1. What objection would there be, if any, to feeding a boiler through the back head, extending the feed pipe within the boiler, say ten feet, with holes drilled in pipe for feed water to escape, the end being closed, and pipe six inches above bottom of boiler? 2. What is the rate of passage from New York to the Vienna fair and back? Answers: 1. This has been done, and there is no objection, so far as we know. 2. From $200 to $300 according to route proposed. Allow $10 per day for whole time proposed to be spent on the excursion and the result will be probably satisfactory. An old traveller, and an economical one, will do it on $7. An extravagant and inexperienced excursionist will spend as much above the upper figure as his letter of credit will allow.

S. H. M. says: Will you inform me if it makes any difference in the power of a turbine wheel whether the water comes into the penstock at the bottom (breast of the wheel) or from 3 to 5 feet above the wheel? Answer: Not unless the current created by the proposed arrangement check the wheel. The head is, of course, the same in either case.

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J. S. P. asks: 1. Where can an incubating machine be had? Is it patented in the United States? 2. I would like to know something more of Adamson and Simonin's process for preserving food. Can you give their address? 3. What kind of cane is used for making paper, and how is it prepared for market? 4. Is there such a thing as a practical drag saw, worked by power, horse or steam, for cutting up trees in the woods where they fall? 5. I have a plain cylindrical boiler 28 feet long by 30 inches diameter; it takes too much wood to keep up steam to 60 lbs. Will it be right to run a small flue of brick on top of the boiler back to the end over the fireplace, and discharge the smoke and heated air through an 8 inch pipe? Will it not make drier steam? Will it injure the boiler in any way, and will it be safe? Is superheated steam any advantage where the engine has only a plain slide valve? Answers: 1. Yes, but we do not know the address of any professional incubator. 2. Address W. Adamson, or C. F. A. Simonson, Philadelphia, Pa. 3. Attempts have been made to utilize nearly every kind of vegetable material, the bagasse from sugar cane included. We do not know of a successful process of manufacture from the latter, however. 4. We do not know of one, but believe that such a machine is used. 5. Carrying a flue over the top of a cylindrical boiler as proposed would probably accomplish the result desired. It would utilize the heat of the gases of combustion more thoroughly, and would make dry steam. We have seen this arrangement used for years with shavings as fuel, with success and without apparent injury to the boiler. We should feel unsafe, and should not advise it, as we should fear that the upper portion of the boiler, unprotected by water, might become overheated and weakened. Dry steam is economical with every form of steam engine.

J. V. H. N. says, in connection with his query as to the working of a turbine wheel, which we answered on page 90 of our current volume: Another question arises: My turbine is a 3½ inch wheel of perfect construction, located 15 feet above the main street, and fed by a three inch pipe. The discharge pipe is, according to your conditions, a perfect draft tube, and is three inches in diameter. The head of water is over 90 feet. The discharge opening in wheel is much less than 3 inches. How can I prove that the tube is full of water? Again, if my theory that the tube must be full of water is incorrect, will not placing the stop valve at the lower end of the discharge pipe keep the pipe full of water when it is opened only so far as to give the entire power of the wheel? Answer: Tap the tube at the lower end and insert a small pipe, bending its inner end upward, and attaching to it, outside, a pressure gage. It will indicate a pressure due to the equivalent hight of water in the pipe. The stop valves must check the flow of water seriously. We should set the wheel as low as we could conveniently, in any case, and, where velocities are as great as they must be in this case, should use either plug cocks or gates to give a straight course for the water.

J. C. W. says: I wish to know the striking force with which a string of tubing suspended in an oil well would strike the bottom, if let fall. Suppose the well is 1,400 feet deep; we have 900 feet of 2 inch tubing, weighing 4 lbs. to the foot, suspended from the top of the well; the tubing has consequently 500 feet to fall, with no appreciable resistance from the atmosphere, as the tubing is open at both ends, and we suppose a case where there is no liquid in the well. To illustrate the principle, can you inform me what is the striking force of a body weighing one pound, falling or moving at the rate of ten feet per second? Answer: Read our article on pile driving on page 208 of the current volume. The tube is a pile and its ram combined. The striking force may be any figure. It will depend upon the nature of the resistance. The work done in stopping it must be its weight, 3,600 pounds, multiplied by the distance fallen through, 500 feet, equal to 180,000 foot pounds. If, by crushing itself and by cutting into the bottom, it is checked in one foot, it will exert an average force of 180,000 pounds. A body weighing one pound, moving 10 feet per second, will do $1\times10\times10\div64\frac{1}{3}=1{\cdot}55$ foot-pounds of work before it will stop. If stopped in one foot, it will exert an average force of 1·55 pounds, if if stopped in one inch the pressure will be $1{\cdot}55\div\frac{1}{12}=18{\cdot}60$ pounds.

W. H. W. says: "On page 145 of your current volume, there is an article headed collapse from low water in steam boilers, which is so much at variance with what engineers have been taught that it at first created surprise. I have thought that the majority of explosions occurred from the want of water, and I know that a great many more are of the same opinion; but coming as it does from such authority as the SCIENTIFIC AMERICAN, it can scarcely be doubted. In a pamphlet sent out by H. & F. Blandy, of Newark, Ohio, it is said that water coming in contact with red hot iron creates a gas ten times as explosive as the best gunpowder. How are we to reconcile the two statements? If your statement is correct, how are we to account for the terrible damage and total destruction done to some boilers that have exploded during the past year? I have long been of the opinion that the pressure generally carried by boilers is not sufficient to tear the plates apart." Answer: As was remarked in the article referred to, our correspondent is one of many who have held similar views. We hope that we have been of some assistance in the good work of presenting correct views on so important a subject. Our article on "Explosions Produced by Low Water," page 191 of this volume, will show how far the circular referred to is founded upon fact. Look up a copy of the *Journal of the Franklin Institute* for March, 1872, and read the paper quoted in our article of March 15 on the "Colburn Theory." It exhibits very distinctly the fact that few can conceive the fearful amount of destructive force pent up in a steam boiler under even *low* pressures.

R. L. D. says: We have had considerable bother in an old flouring mill, by a heavy jar and backlash on the machinery, the engine seeming to backlash and bind on one half of her stroke, travelling south to north. The timber which carried the plummer block and journal was badly held, shifting ¼ of an inch. This journal and timber is situated in the mill, and of course too close to the driving wheels and upright shaft. On lining up the engine, she proved to be five sixteenths out of line from cylinder to wrist. I claim that the jar and backlash is caused by the engine being out of line and binding from the wrist to the cylinder, and that the movement of timber and journal in mill is only the effect, the cause being in the engine. Another mechanic holds the view that the backlash is caused solely by the moving of the timber binding the cogs, said cogs having a clearance of ½ an inch. Which is right? Answer: Such an action might be due to the engine being out of line, or it might result from the closing of the port too early at one end of the stroke, thus confining a little water upon which the piston may strike. We know of one case in our experience in which the trouble was found to be produced by the piston running by the port, closing it up, and then striking on the confined water. Had we charge of the engine, we should take off both cylinder head and valve chest bonnet, expecting to find something wrong in one or the other place. Failing these, we should certainly "line up."

C. C. says: I have been using coal for an engine but am now using coke, and find it much cheaper, and can get up steam a great deal sooner. Is the coke more injurious to the boiler or grate than the coal? Answer: Coke is prepared by submitting bituminous coal to the action of high temperature until all volatile matter is expelled. Sulphur is driven off among other elements, and as this is the only constituent of bituminous coal which injuriously affects iron, the coke is a better fuel than the coal. Coke makes an intense, clear fire, and it should not be forced so as to injure either boiler or grate by burning the iron.

R. S. asks: What are meant by the lead and lap of an engine, and do all engines require the lead and lap? Answer: The lead of an engine is the amount of opening of the port when the engine is on the center. It is greatest in highspeed engines and is given for the purpose of securing full pressure in the cylinder at the beginning of stroke. Some engineers of high reputation doubt the expediency of giving lead in any case. Lap is the amount by which a slide valve extends beyond the port when it stands at the middle of its throw. It enables expansion to be obtained to the extent of from one fourth to one half stroke. The valve of nearly all engines fitted with the common three ported slide have both lap and lead.

A. A. R. says: Is there any way of preventing the action of iron upon copper, and *vice versa*? I have noticed that where there were small copper pipes in contact with iron, they would be eaten out in two or three years; and if large the action would be more on the iron. If there were some way of stopping this action it would be a great benefit to steamboat men. Answer: The action described has annoyed engineers for many years. We know of no way to avoid it, where both metals must necessarily be used. There are few cases, however, in which one metal cannot be used alone.

E. W. asks: 1. Please inform me where I can get a piece of lodestone the size of a hickory nut. 2. Suppose a boiler contains 60 pounds of steam to the square inch. Now attach to the boiler a one quarter inch pipe and connect it to a steam tight cylinder 12 inches in diameter and 24 inches long, made of No. 18 iron. Will the pressure through such a small tube be sufficient to explode the cylinder, or, in other words, if it would bear the pressure, would the cylinder contain the same as in the boiler, 60 pounds to the inch? Answers: 1. Of any dealer in philosophical apparatus. 2. The pressure would be equal in both.

R. F. J. says: How much does clothes line wire (No. 9) and telegraph wire (No. 9), the first annealed and galvanized, expand or contract by heat and cold at ordinary atmospheric temperatures, per foot, yard, or rod? How heavy a weight, hung at one end of a line of such wire, 40 rods in length, would be required to keep it reasonably taut, provided the wire passed through enlarged holes in iron supports placed about 10 feet apart? Answer: The amount of expansion would depend upon the quality of the wire. No two wires expand precisely alike. The average coefficient of expansion for the range of temperature from the freezing to the boiling point is given by different authorities as follows: Lavoisier and Laplace, 0·00122; Dulong and Petit, 0·00118; Borda, 0·00116; Muller, 0·00122; U. S. Ordnance Manual, 0·00126; Tyndall, 0·00123; Boutan, 0·00122; Ganot, 0·00122. For practical purposes, take it at seven millionths (0·000007) of the length for each degree Fahr.

G. W. L. asks: What percentage of power is lost in a steam engine by the use of the crank? 2. Has the crank the same power at all points of the stroke? 3. Do you know of any rule or formula for determining the position of the piston when the center of crank is plumb with center of shaft? Answer: 1. None. 2. No. 3. When the crank stands on the half center in a direct acting engine, the distance of the piston upon the back end of its path is obtained by adding, to the half stroke, the product of the length of the connecting rod into the versed sine of the angle which it then makes with the center line of the cylinder.

J. M. D. says: 1. How is it that, in pressing car wheels on to axles, if the shaft be pressed into a wheel and the gage indicates 1,500 pounds pressure, and if two wheels are pressed on at once (the sizes and bores being practically uniform) the gage will indicate the same pressure? In other words, why does it not take double the pressure to press on two wheels that it does one? 2. What causes the colors on steel when tempered? Answers: 1. For the same reason that, if a spring balance were attached to each end of a line, and if a man at each end were to pull with a force of 100 pounds, each balance would indicate that pressure. The same pressure of 1,500 pounds acts on both wheels, and each yields at precisely that pressure. 2. The surface oxidizes and the rapidly changing film of oxide gives the colors noted.

C. M. asks: Does a locomotive standing still on the track require more steam pressure to start while the wrist pin is at the lower point between the rail and the axle of the wheel than when it is at the top of the driving wheel? Answer: Were the steam cylinder secured to the earth, it would start the engine with lower steam if its crank pin were above the axle. In actual practice, however, the two positions are equally favorable, since in each case the work of moving the engine is the same, and the product of the steam pressure into the distance moved by the piston will also be the same for, say, an inch of movement of the locomotive. The fact that the cylinder is carried upon the locomotive, moving with it, is sometimes overlooked in considering the problem. The pressure on the crank shaft bearings is, however, greatest where the crank pin is above the axle, and least when the pin is beneath. In the first case it is made up of the sum, and in the second of the difference, of the two forces, the one being the effort of the engine and the other the resistance of the track.

F. H. P says (1) that an engine, with a plain centrifugal governor, without cut off, now running at 60 revolutions per minute, with a pressure in the boiler of 60 pounds, will continue to run at exactly the same speed, doing the same work, if the pressure is increased to 120 pounds. 2. He also says that, if the speed is changed to 120 revolutions, the governor will continue running at the same speed (88) to govern the engine. L. G. S. says it will not. Who is right? Answer: 1. The ordinary centrifugal governor, or fly ball regulator, will not keep the engine precisely at speed with varying steam pressures. It is because of this fact that there have been many regulators of other forms invented, as those of Babcock and Wilcox, Huntoon and others, in this country, and that of Farcot and others in France, of Rankine in England, etc., all with a view to the avoidance of this objection to the ordinary governor. They usually have been of the class known as parabolic governors. Our Patent Office contains many models and drawings of such devices. 2. A governor may be made to regulate at any desired speed.

L. A. G. says, in answer to J. E. G., who asked about power in drawing a dray with a long rope: The experiment should be made on a level plane, and the rope should be fastened to the weight at a point exactly level with the hame rings, otherwise the weight will be partially lifted, thus reducing the friction between it and the ground, especially when a "close hitch" is taken. When in this position, the horse sustains half the weight of the rope; the other half helps to increase the weight to be overcome; this is rendered plain by supposing the rope to be stiff enough to prevent sagging. The weight of rope which the horse sustains does not act in opposition to the power he is applying, so that it is only that half of the rope nearest the weight which opposes the draft; and were it not for this one obstacle, it is impossible that the distance can make any appreciable difference.

S. P. S. says to E. B., who asks if an achromatic telescope will answer for the telescopic portion of a spectroscope: Perfectly well, but I should prefer to remove the erecting lenses and thus most likely shorten the instrument considerably. The best cheap spectroscope that I have ever seen was constructed by Professor Wing, of Cornell University, with the lenses taken from an old opera glass; one of these was used for the collimator and the other for the telescope, a bisulphide of carbon prism being employed.

S. P. S. says to S., who wants a good white preservative for wood work on buildings which are exposed to sulphuretted hydrogen: Zinc white, if pure, will answer the purpose. Much of that which is sold as zinc white contains lead. A mixture of zinc white and baryta, without any lead, is extensively used for shipping and does not change by contact with sulphuretted hydrogen.

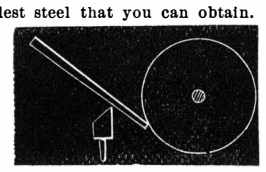
D. M. D. & Co. send a piece of boiler scale, and ask what it is. Answer: The incrustation is sulphate of lime.

J. H. M. says that W. H. F. can cleanse his hands by taking a piece of curled hair the size of a fist; run a needle and thread through to hold it together. Flatten it and rub soap in; and with a little experience, W. H. F. will have as clean hands as any one needs.

T. K. B. says, in answer to W. H. F., who wants something to take the grime off his hands: Wash your hands right in lubricating oil, next in water (letting the oil remain on your hands). After rubbing well, you will find your hands become soft; then wipe with waste. Then use the other recipe, soap, water, and elbow grease.

W. L. T. says, in reply to H., who asked for a remedy for corns on horses' feet: Put on a bar shoe and cut down the bar and crust so as to throw all the pressure off them on to the frog; you will find first that the sensible sole is relieved of the constant pressure which the crust bears upon it laterally, and second, that the jar on the frog, communicated through the shoe from the ground, has a great tendency to secrete healthy horn. The smith should therefore pare down the heel crust, so that, when the bar shoe is applied, it will allow a penny piece to be insinuated between the two surfaces; and in about three months, the heel will grow up and take its own share of pressure. In the mean time a little of the following lotion may be applied daily to the corn by means of a feather: Chloride of zinc, 1 dram, water, 6 ozs., glycerin, 2 ozs., mixed. The cause was, as is usually the case, defective shoeing.

S. P. S. says, in answer to F. H. Q., who asked how to harden steel for turning solid emery wheels: You will most likely find that you can cut your emery wheels much faster with a bar of soft iron than with the hardest steel that you can obtain. The rest



should be placed a little below the center of the wheel, and the iron held as in the figure. The wheel of course runs towards the operator. The theory of the operation seems to be that the particles of emery become imbedded in the iron and then react on those still remaining in the wheel, on the same principle that diamond dust on a soft wheel is employed in cutting diamonds.

J. B. J. replies to W. H. who asked about a a coöperative society, that Fall River Workingmen's Coöperative Association, Mass., is in operation.

S. P. S. says that J. L. S, who asks how to make soft water hard, should dissolve some lime salt in it, the chloride for instance.

[OFFICIAL.]

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March 11, 1873,

AND EACH BEARING THAT DATE.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

24,367.—ORE SEPARATOR.—W. O. Bourne. May 28.
24,493.—FUENACE DOOR FRAME.—P. A. Sabbaton. June 4.
25,153.—CARDING ENGINE.—S. Wetherhed. July 30.

EXTENSIONS GRANTED.

8,589.—MACHINE FOR MAKING KETTLES.—H. W. Hayden.
8,589.—BRASS KETTLE.—H. W. Hayden.
23,320.—BOILER WATER SKIMMER.—A. M. Sprague.

DESIGNS PATENTED.

6,490.—LAMP STAND.—D. Mosman, West Meriden, Conn.
6,491.—WORK HOLDER.—R.W. Perkins, W.Meriden, Conn.
6,492.—LOUNGE.—J. B. Rohrer, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,160.—SOAP.—J. S. & T. Elkinton, Philadelphia, Pa.
1,161.—SHIRTS.—T. J. Irving & Co., Baltimore. Md.
1,162.—RUBBER HOSE AND BELTS.—National Rubber Co., Bristol, R. I.
1,163.—PUBLICATIONS.—F. & J. Rives, A. Bailey, Washington, D. C.
1,164.—BOOTS AND SHOES.—T. W. Seaverns, Jr., West Roxbury, Mass.
1,165.—MAIZOLA.—Warder & Cooper, Valley Junction, O.

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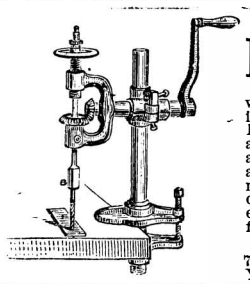

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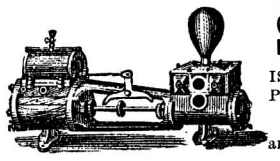

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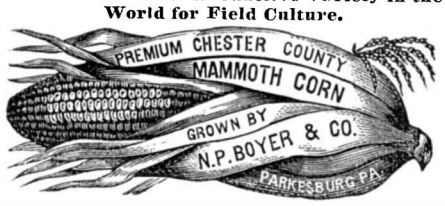

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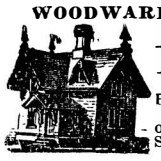

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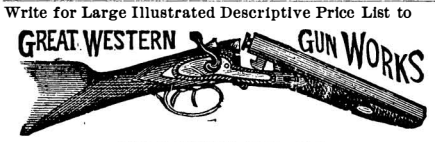

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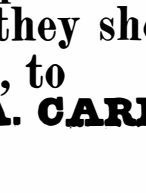

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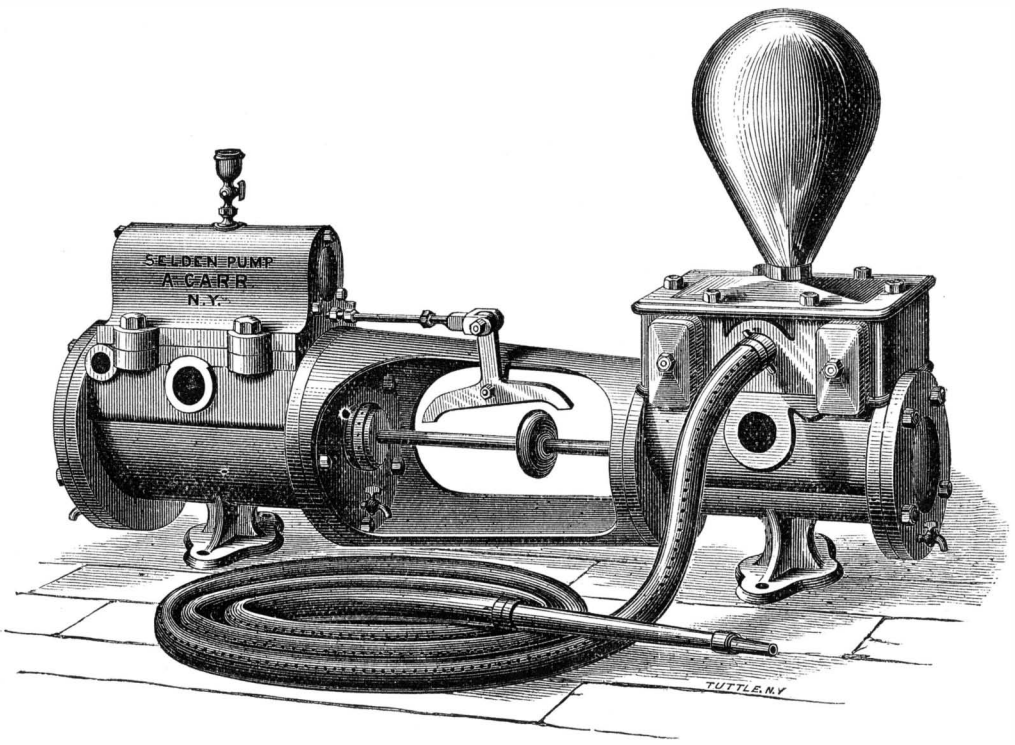

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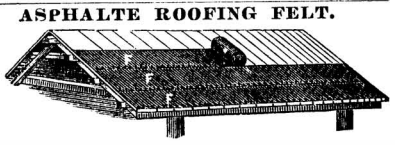

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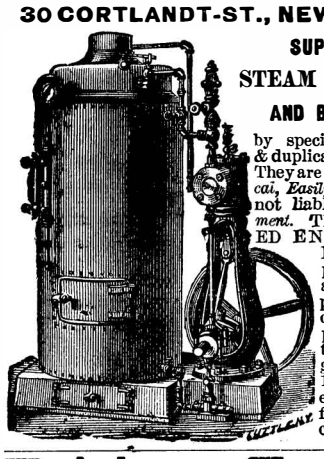

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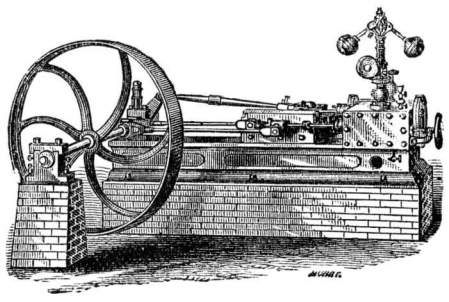

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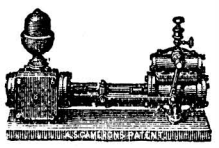

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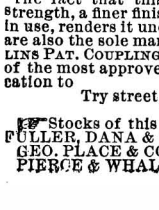

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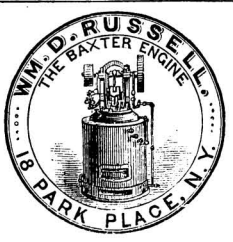

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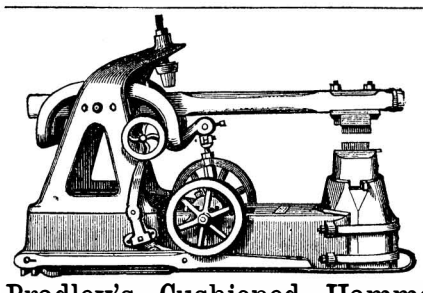

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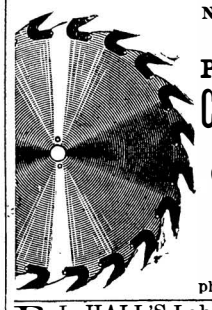

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